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Third, Accident Insurance does not mean exactly what those words at first thought seem to imply. No person can be insured against accidents; they 'will happen in the best of families.' Insurance can be had only against some (not all) of their effects. Death will occur with or without insurance. As, also, the affectionate care and support of the 'bread-winner' cannot be purchased, so they cannot be insured. Insurance can, however, provide pecuniary support for loved ones in case of the fatal injury of their protector.

Again, Accident Insurance has also, perhaps, a still more important function when the accident is not fatal, since those cases are much the more numerous. It has therefore two functions: (1) to provide for the family if the accident is fatal, and (2) to provide for it and its head, if he is not fatally injured; hence, it is the true family insurance.

Fourth, As accidents are never timely, but always very untimely, the distinctive mark of a wise, careful, and economical man is found in his providing himself and family during the years of his need with this cheap form of insurance, taken out from some good company. It will certainly free his mind from one form of anxiety, and thus compensate him fully, even if no accident happens to him.

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In this connection it will be interesting to many, and also when reading the book, to consider that it was planned and most of it written during the many months of the ***unjust imprisonment of the Author.*** (See dedication on next leaf.)

T. S. LAMBERT, M. D., A. M., LL. D.

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RESTORATION

BY THE

"HEAT METHOD,"

OF THOSE

DROWNED,

OR OTHERWISE SUFFOCATED.

A

ILLUSTRATED.

BY

T. S. LAMBERT, A. M., M. D., LL. D.

37,687

NEW YORK:
WRIGHT & SCHONDELMEIER, PUBLISHERS, 419 BROADWAY.

1879.

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DEDICATED

TO

JAMES McCALL, ESQ., TO THE HON. WILLIAM BARNES, AND TO THE HON. ABRAM WAKEMAN,

AS A TESTIMONIAL OF RESPECT, ESTEEM, AND INDEBTEDNESS.

TRUE, dedications are out of fashion. It is well that they are, since the motive which induced their usual fulsome laudations was far from creditable to their authors.

But, I also know, that it is always "in order" to give honor to whom honor is due. Besides, the reader has a right to know that he is especially indebted to the above-named gentlemen for the pleasure and profit of perusing this book; since, while the names of many kind friends are inscribed upon my heart of hearts, as in adamant, and of whom I can say, "When I was in prison ye visited me,"—those noble-hearted men not only did this, but they brought me out, and gave me to my family again, and to my labors among men. I should fail in my sense of duty if I omit to state the fact, in their honor and that of humanity, that they did this uninfluenced by mercenary motives, or by expectation of pecuniary reward, being actuated only by their sense of justice, which they indignantly saw outraged in my case,—an opinion which my friends had the pleasure of finding confirmed by the highest Court of the State.

Although, therefore, confinement gave me the leisure for thought, and for the writing of a considerable part of this book, liberty was essential to its completion; and hence both reader and author have performed a pleasant duty in reading and writing this dedication.

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THEY ARE NOT DEAD.

This is a small book, but its subject is of the gravest and greatest importance to every person. There are also good grounds for the belief that by all it may be perused with corresponding interest. Its object is to show :—

First, that those who have been drowned or otherwise suffocated are not immediately dead, but, for certainly a short, and perhaps for a long, time are still alive, and can be restored to their friends and to the world.

Second, that heat alone is the chief factor or means upon which reliance is to be placed for restoration.

Third, that the application of heat is so simple that it can be successfully made by any person.

Fourth, that the whole process of drowning (or other mode of suffocation) and of restoration can be so plainly described and illustrated, that the whole method of procedure, and the why and wherefore of it, can be easily understood by any reader.

STILL ALIVE.

The papers abound in such paragraphs as the following :

"I can't swim, and if I don't come up in three minutes jump in and get me," said a St. Louis boy, on diving into the water. His companions waited three minutes and then pulled him out; but he was dead.

Oswego, N. Y., August 16.—A fatal accident occurred this morning on the Rome, Watertown, and Ogdensburg Railroad, at Sterling Junc-

tion. While a gravel train was being loaded the bed gave way, burying four employees, named Fred. Baer, Edward Schultz, Nicholas Archer, and Tim Dineen. The last-named was taken out alive; the others were dead.

(From the New York Sun.)

Choked to Death.—An inmate of the Home for Incurables had a piece of duck lodge in his throat, the home surgeon says that he "met the patient at the door of his room, although he had been unable to leave his bed for some time, and endeavored to remove the obstruction, but could not do it; the consulting surgeon came immediately, but his efforts were also unavailing, and the man died from choking."

Now, no one of those persons, so flippantly in the above extracts called dead, was dead at the time mentioned, and in fifteen minutes the proper application of heat alone would have demonstrated, to the most stolid, the fact that they were alive, and had been preserved for restoration. They were doubtless put into their graves while they were yet alive.

If there be even but a small measure of truth in these ideas, and I believe them to be fully true, the subject is one of unsurpassed importance. Understand that all the authorities agree that such persons may be restored immediately after such accidents have occurred; hence, those lives should have been saved.

To show that I do not take extravagant views in such cases, I will quote from the *Evening Post:*

RESUSCITATION BY HEAT.

A REMARKABLE CASE CORROBORATING DOCTOR LAMBERT'S THEORY.

To the Editors of the Evening Post:

The theory of Dr. Lambert that heat will resuscitate a drowned person apparently dead, as set forth in the *Evening Post*, of the

20th, was curiously verified almost under my own eyes a year and a half ago in Havana, where I usually reside.

A black boy of fifteen years of age, strong, well-grown, the slave of a neighbor, early one morning fell into the bay, and was taken out apparently quite dead. He was carried home and laid on the terrace-roof of the house, a doctor was sent for, and all the means generally used for resuscitating drowned persons were tried in vain during nearly two hours. Convinced at last that all efforts to bring him to life again were useless, every one withdrew, and the corpse was left lying upon the roof, exposed to all the fervor of the tropical sun. When, five or six hours later, the coffin was ready, two men went on to the roof to fetch the body. To their amazement the boy was alive, and very little the worse for his adventure. I saw him the next day, and can vouch for the truth of this statement. There was great excitement in the neighborhood, for the doctor had declared him to be perfectly dead.

It is evident that this resuscitation was produced by heat alone, and it is, in my opinion, an interesting corroboration of Dr. Lambert's assertion.

VERITAS.

It was also a great pleasure to read the narrative (inserted hereafter, p. 20,) descriptive of the thought and work of so eminent a member of his profession as Dr. Davis. It was brought to my notice immediately after my first article was published, and quite confirmed my mind that I was right.

The remarkable double testimony brought to light recently by a letter received by the New York *Evening Post*, from a distinguished medical man of our Western Coast, giving the experience of Baron Larrey, is to the point :

HEAT FOR THE DROWNED.

To the Editors of the Evening Post:

The interesting papers of Dr. Lambert in the *Evening Post* upon the use of heat in the resuscitation of the drowned, have a partial

confirmation in the valuable, but now little read, memoirs of military surgery by the elder Larrey. I quote from the first American edition, Baltimore, 1814. He says (p. 38):

" * * * I will mention by what means I had the happiness of restoring some drowned persons to life. If these means are generally known they may succeed in the hands of every one. As soon as I hear that a person is taken from the water I hasten to his assistance, and cause him, in the first place, to be gently laid on a mattress before a large fire; I cut off his clothes immediately, that the body may be exposed to a general treatment. Then, while an assistant makes unremitting and general friction with warm flannels, I exert myself in blowing with a bellows into one nostril, at the same time closing the other; afterward I press the thorax and the abdomen alternately; I then pour into the mouth a little warm spirits; I endeavor to irritate the inside of the nostrils and the throat with a feather impregnated with ammonia. I administer warm enemata* of a decoction of tobacco [the translator properly warns against the danger of tobacco], and take care to present every part of the body successively to the fire. For six hours† I continue these attempts, which appear suited to restore internal warmth and sensibility."

It is obvious that the excitants here used were probably very small factors for good; how far the artificial respiration, thus employed, was important, cannot be determined; but the prominence that he assigns to heat is very noteworthy. Larrey gives no statistics, but asserts that he has "had the happiness of restoring some persons." W.

San Francisco, April 8, 1879.

These very interesting cases will suffice to show that my views are not the groundless vagaries of crude, undisciplined thoughts and conclusions, but that they are founded in fact.

Observe that I am not a partisan, nor bigoted against the use of additional means of restoration, if intelligent persons think them advisable. If strong heat is used pri-

---

* Injections into the bowels.

†Notice the six hours time that Baron Larrey mentions.

marily, other means will do no harm ; if it is not used, they will do no good.

HOW THIS BOOK CAME TO BE PUBLISHED.

It may not be amiss for our purpose, and it may gratify some readers, if I give a brief history of the production of this little treatise, since this review will show the reasons for its form and peculiarities.

Last summer, an incidental circumstance brought to my mind the first knowledge that I ever had of a drowned person having been restored by another by heat alone. As this was an indisputable case which confirmed the correctness of my views, and of the method that I had used in several instances, and as the papers almost daily contained notices of persons having been drowned, and not one of restoration, I felt impelled to write to the *New York Express* as follows :

SIMPLE METHOD OF RESTORATION IN CASE OF DROWNING.

To the Editor of the N. Y. Evening Express:

Dear Sir:—So many deaths by drowning are announced this year that I am impelled by a sense of duty to suggest a simple method of restoration. It is theoretically correct, and I have repeatedly applied it successfully in case of man and animals. Others have used it with equal success. It will certainly be as good as other methods, since I do not remember one restoration noticed this year. Simply and solely heat the person; nothing else is necessary. One way to do it is to take off the cold, wet clothing from a person, wrap him in a sheet, blanket, rug, quilt, carpet, or anything which will hold water; pour water as hot as the hand can bear it upon the material put around the person, filling it with the hot water and replenishing it until the person is heated through. When thoroughly heated, if otherwise uninjured, he will gasp, and after a little time another gasp will follow, others succeeding more and more quickly until breathing becomes

natural. This simple course ought to restore in from one to two hours any person who has not been under water more than one hour, and is simply drowned. If no hot water is at hand, make some fire and heat an abundance of it right away, or take the person to a place where it can be had as speedily as possible, or apply heat in any other way which will thoroughly heat the person. It will also be important to be sure that the wind-pipe is open, so that the breathing apparatus can gasp when ready.

Respectfully,

T. S. LAMBERT, M. D.

A sad case—hereafter narrated—being noticed in the same paper, on the same day when the above article appeared, induced me to write to the appreciative Editor of that paper a fuller exposition, which, to the extent of a compact column, appeared. Half a column was also printed in the widely-circulated *Sun*.

A day or two subsequent, a reporter, unusually intelligent and expert, connected with the *N. Y. Evening Post*, "interviewed" me, and published the "interview" in a very interesting and attractive manner. To explain a point or two, and to add somewhat to his paper, I sent a letter to the *Evening Post*, to which the Editor very politely called attention. This letter elicited the one in regard to the Cuban negro, quoted above.

All these communications, and the extracts from them inserted in numerous papers throughout the English reading world, brought many curious letters, putting numerous questions, some natural and as many unnatural; showing in the total that correct information in regard to drowning and upon the methods of restoration is much needed, not only by laymen, but by many professional men, some of whom, at least, are well educated generally in their profession.

It afforded the greatest pleasure to have my new views confirmed and sustained by eminent medical gentlemen, oft-

en with reference to similar processes adopted by themselves or by others, illustrations from which will be given in their place. The restoration by Dr. Joux, hereafter mentioned, is very remarkable.

All these results suggested that a still more complete view of the subject, presented in a more orderly and thoughtful manner, would be productive of good. I set about doing the work with all the care possible for me to take. This meeting the approval of the Editor of the *Evening Post*, was by him presented to the public in several issues of that paper, occupying several columns of valuable space in that journal, and also in the *Weekly Post*.

His judgment was at once confirmed by the singular extent to which extracts were made by other papers far and wide, while numerous letters testified to the deep interest awakened. Many of these suggested that the matter should be put into a more permanent and handy form. This was also urged orally by personal friends, who were so kind as to express themselves with earnestness upon the merits of the work, one in particular, saying that he wanted a thousand copies to give away.

At first, after receiving this essential encouragement, I thought that I would condense and formularize what I had written, presenting it in a more scientific form as more becoming and dignified in a book; but at once all my friends protested, insisting that it had been proved to be intensely interesting as it was, that I could not better but might spoil it by the alteration that I suggested, and that I should take what I had written to the *Evening Post*, and make such emendations and additions thereto as my mind suggested. I have, therefore, adopted their advice, and shall use the heading given by the *Evening Post*, and the letters nearly as therein found, with wood-cuts and much additional matter, which I hope will give complete satisfaction.

Part I.—Objective Arguments.

THEY ARE NOT DEAD.

DROWNED PERSONS SIMPLY IN A STATE OF SUSPENDED ANIMATION—HEAT AS A REVIVING AGENCY—INTERESTING STATEMENTS OF METHODS USED FOR SAVING THE LIVES OF THOSE APPARENTLY DEAD FROM HAVING BEEN DROWNED OR OTHERWISE SUFFOCATED.

Editor New York Evening Post:

In a note received the other day from Professor Wilder, of Cornell University, he asks: "Can you give me any further information than that contained in your letter to the *Evening Post?* Did you originate the method of hot water? Upon what occasion was it tried upon a man?"* Many like inquiries referring to "communications in the *Evening Post*" indicate a widespread interest among your readers. Three questions are asked by nearly every one: "Do you mean that heat will restore a man who is dead?" "How do you get the water out of the lungs?" "How long after being drowned can a person be restored?" One letter asks sixteen other questions, each germane. Therefore, I think it best to write to you a letter so complete that no question will remain.

That the subject may be practically useful to every reader no pains will be spared to make it plain and interesting.

---

* He also inclosed a synopsis of two of his hygienic lectures, entitled, "Emergencies, and How to Meet them. 15 cts." *Multum in Parvo.* Adapted to the pocket, and should be in every family. G. P. Putnam's Sons, Publishers.

I will give, *first*, definite answers to the above-mentioned three questions; *second*, the factors directly concerned in drowning and in restoration; *third*, illustrative cases showing how the "heat method" has been successfully applied; *fourth*, answers to various questions; *fifth*, (Part II.*), description of parts of the body explanatory of the subject; *sixth*, (Appendix), full details of the modes of restoring those drowned or otherwise suffocated.

To inspire the confidence and attention which the importance of the subject demands, and which from its nature it is entitled to receive, it is sufficient to say that eight reliable cases of resuscitation by means of heat alone (a larger number now) are known. Such success gives promise that a large majority of persons drowned, and who are taken out of water within a reasonable time (a few minutes, hours, perhaps days), and a still larger proportion of those otherwise suffocated, may be restored. A person recently drowned is not dead, and will not be for a long time. If not lively he is yet lifeful. Be not, therefore, alarmed nor unduly excited, but let "faith, hope, and charity" inspire confidence and a cool judgment to aid with deliberate haste in taking the drowned person out of the water and in endeavoring to restore him.

Let this also give courage to, and prevent dangerous alarm in the person in danger of, or really drowning. This is a matter of great consequence, since many who fall into the water are not simply drowned, but being frightened, exhausted by their struggles, or chilled by the cold, there is at least a complication of drowning with syncope (fainting), congestion of the brain, or other condition, which makes the

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* This will be omitted in some editions, that those who do not want to read it, need not buy it; such editions will be plainly indicated upon the cover, or upon the title-page, or upon both.

case less easily managed, and the result more doubtful than simple drowning would be. These complications very much prolong the time needed for the reanimation of the suspended life—hours may be required where minutes would be sufficient in mere drowning. This will, in part at least, and probably in great part, account for the great variation of the length of time required for restoration in different cases, in which there is no difference in the coldness of the bodies. Most of those efforts which have been successful have occupied but a little time. Others have required an hour, two hours and a half, six hours, eight hours, and eight hours and a half, which is the longest time, to my knowledge, used successfully for the restoration of a suffocated person. If that time and labor had, if necessary, been bestowed upon every person drowned or otherwise suffocated, how many would have been restored no one can say. Certainly many would have been, while perhaps even a longer time was needed to restore some who were restorable. As we cannot tell, unless there is some obvious injury, who is restorable and who is not, who is simply drowned, and in whom there are complications, perhaps rendering every labor fruitless, the plain course is to labor faithfully and hopefully to restore each and every one who becomes inanimate otherwise than by disease or by some deadly injury. The reward will seldom be more or other than one's own self-respect and consciousness of having performed a duty, since accidents usually happen to those having only thanks to give ; yet is not that self-reward the very richest that a true man can enjoy.

THE THREE QUESTIONS.

Let the three questions, which everybody asks, be now conclusively settled.

First—A person once dead cannot be restored by heat, nor

in any other way. No such attempt is proposed. Life does not thus go backward. That which is dead can "come to life" only by being dissolved and going through the regular gate-way of vegetation, namely, through the roots and leaves of plants. Some poet has likened death to sleep; another calls them twins; but science, looking deeper, sees between them no resemblance, nor more between death and drowning. Animation, sleep, hibernation, and being drowned are only different states of positive life, more or less dormant in the last three states named; each being a high form of life; the last even being world-wide from death; indeed it is, in its case, the wisest possible mode of preserving potential life until favorable conditions again permit the manifestations of its activity. Provisions for hibernation are constitutional in some, and those for recovery from injuries are found in all animals. Is it then extravagant to suggest that in case of drowning active life is more than wisely suspended in anticipation of restoration? The closed windpipe protects the lungs, respiration ceases, the blood everywhere stops in its course, as a soldier on a march halts at the word, but ready to move on; while in ordinary death the arteries, acting after the heart has ceased to beat, nearly empty themselves—thus throughout the body quiet reigns, which, though mistaken for the calm of death, is merely the suspension of active life, tending then—of all things most essential—to retard the loss of heat, especially from the internal organs of the head and trunk.

It is no purpose of science to play the magician, nor to pretend to the supernatural; but as spring warms into activity the live yet dormant buds and hibernating animals, so it is believed that heat has the power to warm into activity the passive, yet lifeful (not lifeless) forms of the drowned, and of those otherwise suffocated.

Second—Fortunately no water "gets into the lungs" in

drowning. If there did, as there is no way by which it could be got out soon enough to be useful, death would occur in every case. Some persons have been restored after being under water a long time, and when no effort was made to exhaust water. Again, the whole structure and action of the breathing apparatus deny the possibility that water—in such quantity as will injure the drowned person—can "get into the lungs." They have been constituted to receive air and to resent the access of water. If a person places his finger upon his "Adam's apple"—larynx—and swallows, he will perceive that as soon as any substance—saliva, drink, food, etc.,—reaches the throat, where it is liable to "get into the windpipe," this rises to close itself against the threatened intrusion. At the same time mark that the breathing, whatever its stage, stops at once, and the whole breathing apparatus instantly pauses, remaining perfectly inactive. No danger, then, exists that water may be "sucked into the lungs," since the "suck" does not work. It may be argued that sometimes substances do "go down the wrong way." But what a disturbance they excite! As no strangling occurs in drowning, with rare exceptions, it is evident that water does not then "go down the wrong way." One question is, "Does the windpipe remain closed when the person has become unconscious?" Neither consciousness nor volition, as will be presently proved, was necessary in, nor had anything to do with, closing the windpipe. Why can it not remain closed without them? It can and does.

Once more, all directions for artificial respiration, from those of Marshall Hall to those of the present day, say "draw forward the tongue and thus raise the epiglottis," or cartilaginous cover of the windpipe, which cover is situated beneath, and attached to, the back part of the tongue. Whoever tries to follow this difficult direction will be convinced that the windpipe is safely closed at the time when a

person is drowning, and after he is drowned. Would this direction be uniformly given unless the windpipe was uniformly closed? Still another fact remains to be stated, which some may think might have been mentioned first and saved words. No water is found in the lungs of a drowned person unless he has been dead for a considerable time.

If misconception and prejudice are yet so bomb-proof that what has been said does not convince every one of the truth that water—except in rare cases, in minute quantities—does not enter the lungs of the drowning persons, he must be referred to remarks further on, which will undermine every vestige of unbelief.

Thirdly—No trustworthy indication of the earliest moment or hour when life in case of suffocation is extinct is known. Closed or nearly closed eyelids, especially if when opened they re-shut, indicate life; but open eyelids do not certainly indicate death. The same is true of the mouth. The pupils and the effect of a bright light upon them also afford a clew. But neither fact nor theory, as yet, yield anything definite. Under eight hours Littlejohn would relax neither hope nor effort to restore the drowned. Another writer says that when the heart ceases to beat death occurs; from what we know this is a gross error. The fact is that neither study nor experiment has been applied to this field as its importance demands. The longest time known to the writer, upon a personal authority, is two hours and a half used in restoring the young lady drowned in the Norwalk disaster. A dog which had been under water much longer than that (five hours,) recovered under the influence of the sun's rays. The case of the Cuban negro, and that of the person drowned at 44th Street, hereafter narrated, are especially noteworthy in this connection. The very strong negative evidence is that there is no apparent reason, as we shall conclusively see, why, under proper conditions, a person

should not recover from suffocation during any time before decided decomposition occurs. If, then, the appearance of a drowned person is good, though days or weeks have elapsed since he was drowned, go to work and try to resuscitate him. Will it do any harm to try ?

FACTORS IN DROWNING AND RESTORATION.

Three active factors of the well-being of the body are noticeable as stopped by drowning :

(1) Breathing is stopped.
(2) Circulation is stopped.
(3) Production of heat is stopped.

Consciousness and motion, the want of which produce the most appalling appearances of the drowned, are also stopped. Of course the body is becoming cool more or less rapidly according to its weight, especially that of its fat, and according to the temperature to which it is exposed.

It seems to have been taken for granted in the construction of those parts of the body related to the above factors that man is a social being, and that a person's fellows would have sufficient intelligence and humanity to aid him to the simple extent necessary for his restoration from suffocation. It is evident that man was made with reference to the social status of the future when teaching shall be practical.

In restoration, the three factors must be considered in a reverse order.

(1) Restore heat.
(2) Restore circulation.
(3) Restore respiration.

Consciousness and motion will follow. Indeed, facts demonstrate and theory indicates that when heat is again completely enthroned the other two of the three factors will work without further care. The heart and pulse begin to beat a little before respiration starts ; this will be sure to follow, with all the other functions in its wake.

To stimulate a scientific faith and belief in the facts sufficient to induce action in more important cases,* drown a fly, bee, ant or other convenient animal (don't "give this away" to Bergh), then place it in the bright sun's rays; as soon as it is warm and dry it will show that its life was not gone.†

HEAT—THE PRIME FACTOR.

Spring brings animation to all nature. Its heat melts the iceberg and the glacier. Heat warms the seeds into development and alone incubates the bird in the egg; in short all the realms of life own that heat is their *sine qua non*, so that we may almost say that "heat is life and cold is death." It should therefore be the first factor to secure attention in case of drowning. To rub the body before it is warm, hoping to excite that circulation which nature has suspended, is not only not useful, but injurious. To circulate cold blood, if it could be done, would quicken none of the tissues; warm blood is an essential to their activity; and a circulation of cold blood, by still faster cooling the body, would be sadly detrimental. Fortunately, then, it can't be done. For like reasons artificial respiration before the body is warm and the circulation started, only does harm, unless it is de-

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* Of course the very meaning of the words "faith" and "belief" imply, at best, a doubt, a shade at least short of knowledge, of reliable certainty; nor is it assumed nor pretended that the experiments mentioned, nor any number of like experiments, however successful, yield knowledge in regard to man in a similar accident; they merely tend to lead the way, in case of certain accidents, which are the only experiments that can be tried upon him, to deductive efforts; these will develop the scientific truth affirming or denying our belief or faith, developing them into that absolute knowledge which we are seeking.

† A grocer bought one of the first fly-catching machines; said that it caught millions of them, but did not diminish their number. He drowned them and threw them into the gutter on the south side of his store. When told to watch them he found that as soon as dry and warm they flew straight back for more sugar and another bath. He then burned them, and his machine was satisfactory.

sirable to empty the lungs when suffocated by smoke or poisonous gas inhaled ; this will be more clearly explained farther on.

CASES ILLUSTRATING HOW HEAT HAS BEEN APPLIED.

Dr. Lynch of this city, when living, several years ago, restored a man who had been in the water about half an hour, and had been carried so far that about another half hour elapsed before the doctor began to operate upon him by putting about him strips of carpet torn up from the floor, and soaking them with hot water, tea, coffee, etc., which the neighbors had. The man "came to" in about an hour.

Dr. Davis, of this city, when living in Ohio, restored in half an hour a boy thirteen years old who fell from a horse into the river, and was under water some time. The doctor put around him hot dry blankets, frequently changed. He prefers dry heat. It will often be best. It makes the least muss.

The following very lucid and interesting narration was given by a Reverend gentleman of this city, who became interested in this subject, and thought it very important to the public :

Mr. Editor, dear Sir :

In confirmation of Dr. Lambert's idea in regard to the restoration of the drowned, permit me to give the following case narrated to me by Dr. E. K. Davis, of 82d St., New York, for many years Professor of Materia Medica, in the New York Medical (now Bellevue) College.

When he was practicing medicine in Chillicothe, Ohio, he was called to attend a case of drowning which all persons around him believed would prove hopeless.

The circumstances were these: A wealthy gentleman, whose family physician he was, kept two horses. The coachman took these horses out to wash and groom. A bright, intelligent son of the gentleman, aged 13 years, wanted to ride one of the horses, and his

wish was readily granted, as he was to be accompanied by the groom who rode the other horse.

It was proposed by the lad that they should ride their horses into the river, which would give the horses a bath and himself sport.

The obliging coachman—not so prudent as kind toward the boy—consented, and they rode into the river.

The horse on which the lad rode slipped upon an unseen stone, and stumbling, threw the boy over his head into the river. The boy did not know how to swim. In the excitement the coachman did not succeed in rescuing the boy until he had sunk for the third time. Being greatly horrified at what he supposed was the untimely death of the boy, he did not get assistance for some time. From the time when he fell into the river until he was taken to the nearest house it was full 30 minutes.

Dr. Davis came in and at once wrapped the apparently lifeless body in very warm blankets, replacing them every two or three minutes. In about fifteen minutes the drowned boy heaved a faint sigh, followed by a feeble groan. In ten minutes more he was entirely restored to consciousness.

Nothing was done but to apply heat in the form of very warm dry blankets. And this treatment was perfectly successful, to the great joy of the parents and friends of the unfortunate lad.

So Professor Davis proved by his own professional treatment that heat is the agent to restore drowned persons. He believes there is no treatment to be compared to this in restoring drowned persons.

The philosophy of this method of treatment is grand, and its correctness is thus put beyond all question. Respectfully yours,

TRUTH.

The colored Cuban boy mentioned in the *Evening Post* was restored, it seems, simply by being accidently "laid in the sun" on the "terrace roof" after the efforts of two physicians, attending to the ordinary means, had failed, and they had pronounced the boy dead.

Some years ago a man was taken out of the East River

at Forty-fourth Street, having been under water some time. As he apparently had no friends and had no directions about him, he was placed upon a plot of grass near by, fortunately under the blazing sun of a summer's afternoon. The police did not come for several hours; they then took him upon a stretcher to the station, where it was found that his heart was beating. A brisk rubbing of his ears excited him to complete activity. Why that form of rubbing was used I cannot guess.

Professor Wilder, in the very valuable "Emergencies and How to Meet Them," says: "It is reported that Dr. Joux, of Brussels, has restored a drowning man by applying to his chest plates of iron nearly at a white heat." Such "heroic treatment" was not necessary to heat him, though of course it did do it. I judge that the heat was applied, not to warm the man, but to act as a "*moxa*," that is to say, an application to burn the flesh and nerves, and thus excite the nervous centres to action. The "intention" was not, I think, "fulfilled." One effect was, of course, to heat the body, but so far as the plates acted as a "*moxa*" I think that they were injurious.

Prof. Wilder also asks: "Upon what occasion did you try the hot water upon a man?" Upon a steamboat leaving Cleveland for Buffalo, July 4, 8 P.M., 1843. As the boat was about to start, a hand, helping to carry on board the last trunk, fell into the water, and soon sunk. They fished him out of the water and hauled him on to the deck, a little after nine o'clock, and the boat then left its wharf. A little before ten the captain came to my room and asked if I would go down and judge if anything more could be done; he said that the man had been rolled on a barrel, etc. I went. He was cold and apparently lifeless. In a flash, suggested probably by the heat near by, experiments tried a few years before upon fowls, a dog, and a cat—restored by

heat alone—came into my mind, and I said to myself, Why not try the experiment upon this man? Here are plenty of means; it will do no harm; it may restore him. I said to the captain that if he would order a mattress, some sheets, a pail of hot and of cold water, and shut off the currents of air, I would go to work. He replied that it would do no harm to try. What I suggested was done. Wet sheets, hot as my hands would bear, were wrapped about the man nude, his head inclusive except mouth and nose, and changed as often as they were a little cooled. To-day, with those abundant resources, I should wrap the sheets about him with clothes on, and keep the whole soaked with hot water. About eleven his pulse was noticed, feeble and infrequent; after about five minutes a gasp came, and in a seemingly long but really short while another occurred. I then sat back, contented to watch the increasing frequency of pulse and breath. At twelve o'clock he was conscious and spoke. The captain and the men looked as if one had come from the grave, and it then seemed much the same to me. About one o'clock he put on his clothes and walked off to bed. So did I. The next morning he was helping to unload the boat, very mad. Such a temper is usually, I believe, attendant upon resuscitation. Why, I cannot guess.

Several years after, two children under water, one under ice, each about the same time, from fifteen to twenty minutes, who had been declared to be dead, were, at my suggestion, restored in less than half an hour, by hot wet sheets.

A fourth case was that of a young man in the Tombs, this city, last winter (1878). He had suffocated himself by a partial hanging. When he was taken from his cell, and I was called to him, he was breathless, and his pulse and heart beatless; his hands and feet only were cold. I ordered hot wet cloths to them, which were immediately applied. In five minutes his heart was beating: breathing soon followed, and

in a quarter of an hour he was talking. No effort except by the application of heat was made in any of these four cases to restore animation, and in each case the most convenient way was by means of hot wet cloths.

The professor asks: "Did you originate the hot water method?" Not "hot water," but "heat method" is the better form of question. Nor is the application of heat in the restoration of the drowned new; it has, however, been considered as a subordinate, while it is the principal factor. I cannot say that I originated this idea, nor do I wish to do so; indeed I am glad to be able to show that it has occurred to the minds of several persons, and to have been successfully tried by them, as I herein prove. So far as I am concerned the idea seems to have originated itself. I blundered into it accidentally and then did not see it at first. When about eighteen years of age, and pretty well read in medical works, I found in the water-tub of the barn a hen, partly on the ice and partly in the water, partly frozen and partly not. I took her into the house and laid her upon the kitchen stove, in which I had a little before made a fire. I then went out, and after a little time returned, and was much astonished to see her walking about the floor, since I had no idea that she was alive. I thought upon reflection during the day that there must be some mistake. I therefore drowned another hen sure, and laid her upon the stove, not so warm as to scorch her feathers, and watched her. She "came to" systematically, and so did another, and I made up my mind that that was the way with hens. But I did not generalize the idea. One hot day, the next summer, as I was watching the first hen with a brood of chickens, and wondering how the hen could have been so much frozen without injury, it occurred to me that on one summer's day, when I was a small boy, my mother told me to put our cat and three of four kittens into a bag and take them to Bare-

hill brook and drown them. When I reached the bridge I tied a stone and a long cord to the bag and pushed the whole into the water. As soon as there was no more motion in the bag I hauled it out, emptied its contents upon the broad hot stone, and started for home. The "Old Oak" by the wayside tempted me awhile with its cool shade and its acorn cups. When I reached home my mother said, "Why did you not drown the cat, as I told you?" (She knew that I did not wish to do it.) I insisted that I did. "There is no use in telling that story. Go and look out of the back door and see what you have to say." I was astonished, if ever a boy is in that state of mind. Sure enough, the same cat I left on the bridge as dead was sitting there licking her fur and that of the kitten left at home. But I spoke the truth with so much earnestness that my mother was nonplused, and let it pass with apparently a strong impression that something ought to be done. That cat performance had always haunted me, and being brought to mind in connection with the then mystery about the hens, I asked myself if there might not be a like cause in both cases, and as I had a few days before obtained a large dog for experiments, I forthwith bagged him and subjected him to the water ordeal. He was no wizard, but drowned easily. I did not dare to risk him long under water; as soon as he was quiet and his pulse had stopped I took him out and laid him in the hot sun on the hot boards leading into the barn doors. In a short time I had the pleasure of feeling his pulse and of seeing him breathe. I tried the experiment the next day in full faith, and for a long time, as I then thought, leaving him under water full twenty minutes, and in about half an hour the dog and myself were equally happy in his complete restoration—the dog over a large piece of meat that I gave him as a kind of compensation, a kind of Bergh memorial for his instrumentality in the successful ex-

periment; and I because—well, is there any mental gratification equal to that arising from an experiment that confirms a scientific deduction? I thought I would make it sure by drowning the cat. She proved to be of the same nine-lived race with the one I left on the bridge, equally faithful to the master power of the sun's rays. I was now prepared to commend to my mother's attention the conclusion I had reached. I had always supposed that a suspicion yet lurked in her mind about the cat story. I was surprised to hear her say that she did not remember anything about it, but she said that I had better not be trying any more experiments with the cat, as she was a good mouser and could not be spared. My mother's poor memory was not long after explained by a farmer's wife happening to remark in my hearing, "Mothers forget drefful easy the bad doin's of their boys."

I have given the history of the "heat method" in my case; but as it is chiefly a chapter of accidentals I do not feel especially proud of it, since I did not have the scientific acuteness to apply the idea that lay open before me to the restoration of man, not even in thought, until years after, when the conjunction of circumstances could not but recall memories and induce their practical application. I may be entitled to credit for studying the philosophy of the "heat method" and for disseminating it—for nothing more. How Dr. Lynch came by this idea, I have no means of knowing. Dr. Davis, I judge, was indebted to his own thoughts for the suggestion of the method.

(Thus I wrote for the *Post*, and it seems that I was right, since wishing to know the fact I called upon Prof. Davis, and found him a very affable, intelligent gentleman, and an expert in the theory and practice of his profession, one in whose judicial observation and narration of facts I should place the fullest confidence. When I asked, how he

came to think of applying heat for the restoration of the lad, he, in his own vivid expressions, as nearly as I can remember, replied, "Well, three or four years before that occurrence, I attended lectures in Cincinnati, and among others heard those of the celebrated Prof. Eberle, being very much impressed with one upon heat as a recuperative means. He did not speak of it in relation to drowning, but spoke with great emphasis of its value in many instances when the balance of life was just upon the equipoise. I often reflected upon what he said, and when called to that lad, cold, wet, and flabby, it occurred to my mind, although I had no idea that he could be restored, that if ever there was a case in which heat would be useful, this was the one. There was a shanty on the bank of the river, and in it a fire in a stove. I therefore said, bring him in here, and asked the woman if she had any blankets. Turning down a bed she showed some, which I at once threw directly over the stove. Meantime, I cut off the wet clothes from the lad, and placed him on the bed, and wrapped the scorching hot blankets around him. I remember that the blankets were scorched, because afterwards the woman wanted me to pay for them. Others also were brought and heated for use in their turn. Meantime I drew out his tongue, raised his arms above his head, and pressed his chest, trying to get a little air into his lungs, though I do not think that amounted to much. In a short time I was electrified by seeing him give a kind of gasp, and as I kept on putting around him hot blankets he soon breathed regularly, and was taken home with great rejoicing by his family and neighbors."

Notice in particular what Dr. Davis says about drawing out the tongue, his object being to make sure of an opening into the lungs. This is often a very important point, since a person cannot gasp if there is no opening to admit

air to the lungs. This can be made by drawing out the tongue, or by pressing the windpipe down by taking hold of the Adam's-apple, or better by doing both at the same time, although there is no way so sure as cutting a slit in the front part of the windpipe, as hereafter described.)

This method may have been promulgated years before I was born; indeed, Baron Larrey's remarks prove that it was. I never heard of it as practiced by another until last summer. I do not think that it is of the least account who originated it. It is a good method. It cannot be less effective than the other methods, since I have not heard of a person restored by them during the whole year, but I have seen accounts weekly of persons drowned and otherwise suffocated and given up for dead; whereas in my limited sphere this year I have by the "heat method" saved one called dead who had been suffocated by self-hanging.

One letter asks: "Why did you not sooner publish this simple method?" I had often explained it in my lectures, and as soon as I learned that it had been successfully tested by another, I hastened to put it before the public. Since then I have written many long or short articles upon it, hoping to save some. My neglect probably arose chiefly from my never, until that summer, having had any personal interest in a drowned person nor in his friends. But the day on which my first brief article was printed, an account of the drowning of a son of one* who has proved himself an excellent "friend in need" appeared in the same newspaper. I was instantly pierced with keen regret, and felt that I had been very remiss in a duty to the public, since as it seemed to me, had I taken pains to place the "heat method" before the public it might have saved this valuable man, accomplished physician and much-loved son.

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* The Hon. Abram Wakeman, formerly Postmaster of N. Y. City.

Many metaphysical and irrelevant questions are asked, such as, "Does life wait, or does it return, in case of recovery?" "How long do life and spirit wait to find out whether or not anything is going to be done toward a recovery?" etc., etc., *ad nauseam*. But as these are not practical, as no man can answer most of them, nor would wish to bother his brains with them if he could solve them, I certainly shall not try, but shall pass them.

WHEN IS A MAN REALLY DEAD?

One doctor, however, asks a very thoughtful question: "Are you sure that life can be re-excited when the heart of warm-blooded man has stopped, his consciousness faded, his delicate nervous centres have become quite cold, his muscles have passed into *rigor mortis* [stiffness of death], and his life has apparently taken its last farewell of his body?

This, if possible, is a great and glorious restoration. I do not hint that I think it absolutely impossible. To convince and suggest that it can be done, though it fail, is a grand idea and full of humanity, since how many are the cases in which, if successful, it will be a balm to the deepest anguish the heart ever experiences, the sudden taking off of loved ones in the prime of life. I know by experience what it is, I had a son drowned. Certainly no harm can come from having the whole subject re-investigated, or rather investigated, since what is supposed to be known is mostly but unscientific assumptions based upon popular notions, and derived from appearances. I will gladly aid you herein."

It must be acknowledged that only a probable affirmative can now be given to this profoundly interesting and important question. Yet it does not seem singular to any one that an animal or person should recover after being drown-

ed for ten seconds or for ten minutes. Indeed, it is expected. Why, then, surprising after ten hours? "Oh! there is such a difference." How? Mark the facts. When a second has elapsed, the person has during all that time been utterly breathless, pulseless; his heart beatless, his whole body motionless and unconscious. No change has occured except that he has been growing cooler. The same will be true of him at the end of ten minutes. Has the coolness as yet produced any changes that are irremediable? Certainly not, since in some cases he has recovered. That he is breathless, pulseless, his whole body motionless and unconscious, is not fatal; nor that he has somewhat cooled. In the first particulars there can be no change, nor liability of disaster during any period of time before decomposition, or some structural change, has taken place; we can only ask if the lowering of his temperature will of itself, or by the changes it may induce or permit, make recovery impossible. There is the whole matter in a nutshell. Now, Dr. B. W. Richardson, whom it is a pleasure to quote as one of the most intelligent, observing, experienced, and, above all, as one of the most judicial of experimental physiologists and pathologists, found that living flesh has a neutral reaction, while as soon as it is exposed to the air it shows an acid reaction. But the drowned person is covered from the air by the skin, and by immersion, which seem intended to preserve the person in a restorable condition, and as he remains restorable longer in cold than in warm water, it would appear that the lowering of the temperature does not militate against but favors his recovery. If that be so what is there to make us so certain that he cannot recover after even several days submersion in cold water, or in earth, or indeed after being frozen? Dr. Richardson also says that if when *rigor mortis* has occurred in an animal if it be frozen when it is thawed the *rigor mortis*

will have disappeared. Hence it appears that coldness is not the cause of *rigor mortis*, nor is *rigor mortis* either a cause or a result of death, since these thawed animals lived. Hence the expression *rigor mortis* is not correct, for the stiffness is not that of death.

In the case of a man wholly frozen it is assumed that he is dead. Yet we know that many animals of many kinds are every winter frozen, and then "thawed out" and restored. The eye of a toad is the most delicate and beautiful of animal objects, yet the whole animal has in many experiments been thoroughly frozen and perfectly restored.* It will be said, "fish, frogs, etc., are cold blooded." Is that an argument? They have an organic nervous system as perfect, as delicate, and as efficient as the warm-blooded animals. Beside, do we know that no warm-blooded animals, thoroughly frozen, have recovered? The hen instanced by me was certainly frozen stiff in her head, neck, one leg and wing, half at least of her trunk walls, and probably the greater part of their contents.

That high authority, B. W. Richardson, M. D., F. R. S., etc., of London, according to the report in the *Medical Times and Gazette*, said: "I direct the freezing spray for a few seconds upon the head and spine of this large, powerful frog. Every function of life is immediately suspended. I place the animal in your hands; it is like marble—a hard frozen mass. You declare it to be dead, but it is yet alive; its animation is only suspended; it begins at once to receive heat from the air; its pulse beats again; soon it leaps; it is again animated and has received no

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* It is a common error that the crystallizing of the water, and its necessary expansion by freezing in delicate structures, destroys them. As the eye includes all the active tissues, notably the nervous, and a large proportion of water, its refusal to die, or to suffer material injury when frozen, refutes the error conclusively.

permanent injury. You ask how long a frog could be kept in this state of suspended animation? I believe that if kept frozen for a century, or for any number of centuries, it would be again animated, or as we say alive, upon the restoration of the proper degree of heat."

True, the frog is a cold-blooded animal, but in another lecture, speaking of pigeons, which are warm-blooded, he says: "I have known the brain to be frozen forty-six times in the same animal with no more harm than if it had been narcotized by chloroform. The number of times that a brain is frozen does not affect an animal injuriously if time between each freezing be allowed for perfect recovery, and also plenty of food be given to the animal." Again, in the next lecture he says: "I froze the brain of this pigeon at my last lecture, during which the bird began to recover; it quickly regained all its natural functions, and here it is, as healthy as if it had not been subject to any disturbing cause. * * * By the freezing of an animal we fix all the water of its tissues, we stop evaporation, we suspend motion, we arrest waste, but we do no injury which may not be removed by the re-solution of the water, by the resuscitation of motion—all accomplished by the restoration of the lost heat. * * * How did we deprive the animal of all sensation and motion? Solely by abstraction of heat from his system. How were they restored? Solely by the restoration of heat. When the nervous centres are reduced in heat there is a powerless organism; when their heat is replenished the whole body awakens, proving that cold is productive of torpor, but not of death, to the nervous centres."

We also know that it is the custom of persons fishing through holes in the ice of our ponds in winter, as I have often done in boyhood, to throw the fish which they catch down upon the ice, where the fish soon freeze solid

and may be carried home and kept in a cold place for days or weeks. When thawed they are invariably seen to be alive, and, if put into water, will continue to live, as one, for years which I put into our well did live. There is a shallow pond in Hebron, Washington County, New York, well stocked with fish, which freezes from the surface to the bottom nearly every winter, the fish included; but they are alive all the while, and lively when the spring heat melts the ice and thaws them out.

This proves that cold is productive of torpor, but not of death to the nervous centres; and we have herein testimony for the "Heat Method" all the more forcible because not directly given for the purpose for which it is here used.

Life stays by many animals while they are frozen, why should it not be as good-natured in case of man, and stay by him when frozen, drowned, or otherwise suffocated, at least for a few days, if necessary, (we know that it does stay a few hours,) until favorable conditions for its active manifestation occur? It certainly would be as fair for it to wait on man a few days and see what is to be done, as it is to wait for weeks or even months in a frozen fish, and then wake to activity to be thrown into a frying pan.

I have again, and for a reason, indulged in the use of the language and of the ideas of my questioner. But while I would not presume to criticise so excellent a gentleman, so learned a scholar, and so distinguished an ornament of his profession as my friend, it will not be disrespectful for me to dissent entirely from his ideas of the nature and independence of life, since I think it entirely dependent, and simply the property of that in which it inheres.

A letter received yesterday asks: "Will you kindly answer the following question: Is it probable that a body could have been restored which had been out of water and

considered dead for two hours, though it had been under water a very little time, simply by pouring on it very hot water and wrapping continuously in heated blankets, when nothing was known about raising the head or keeping the body out of currents of air, when, as before said, two hours had elapsed since the body had been taken from the water ? T. G. A."

It appears that "T. G. A." has read my articles in the *Evening Post.* But I thought that I answered in them, as plainly as possible, the very questions that he asks, and I will suggest to him a careful re-reading of them. If the person was in sound health and did not receive any blow upon some vital part when drowning, he could not have been dead in two hours, and his suspended animation could have been restored easily by following the directions given.

The question of the quoted letter is, Whether or not "very hot water" would have effected the restoration, without attention to the position of the head, or to currents of air ? The slight raising of the head, which is best, is not essential ; and cool currents of air would simply retard the heating of the body. The words "very hot water" may give a wrong impression. Care should be taken that it be not so hot as to scald. As high a degree of heat as the hand can bear is the best, a lower degree will answer, but certainly not below one hundred degrees Fahrenheit. If the heat is lower than the hands can bear, it must be applied for a longer time. Dr. Richardson,* of Cayuga County, N. Y., in the *American Journal of Medical Science,* speaks of his treatment of a newborn child in which all ordinary methods had failed. He "laid its corpse-like body upon a

* Joseph G. Richardson, M. D., now of Philadelphia, and Prof. of Hygiene in the University Medical School. Also, the Author of a recent excellent publication, "Long Life and How to Reach it." 30 cts. Lindsay & Blakiston, publishers, Philadelphia.

bed of flannel on the hearth of a large cooking stove, heating its arms and legs alternately, only a little short of the blistering point, and then by firm centripetal friction drove the hot blood along the desired course; the effect of this treatment was miraculous." One sheep-breeder said to him, in reference to young, feeble lambs: "When everything else fails I put them close before the stove and give them a good roasting; that often brings them to life again. It is astonishing what an amount of heat they will bear, and it does them good, too." Heat is therefore seen to be an essential if not the only trustworthy restorative means in case of drowning, or of any other mode of suffocation. The extraordinary heat which the sheep-breeder said that lambs would bear may be attributed to the thick coat of soft wool with which they are covered, and which of course tends to keep out heat as well as to preserve it. It may be however, for certain facts look that way, that charging the feeble animal, or the suffocated person, with surplus heat considerably above the natural temperature tends to invigorate and restore the enfeebled powers.

In the same manner as the woolly coat tends to prevent heat from entering the body, so will fat prevent its internal parts from being warmed readily, since fat is one of the worst conductors of heat, preventing the body from being quickly cooled, and from being rapidly heated, by external applications. Hence a fat person, if thoroughly cooled, will be much longer in recovery than a lean person, but will be more readily restored if only a brief period has elapsed.

It will not be amiss here to call especial attention to Dr. Richardson's statement that he, by "firm *centripetal* friction drove the *hot* blood along the desired course." By "centripetal" he means that he forcibly pressed his hands upon and moved them up but not down the arms and legs; and by "desired course" he means to drive the "*hot* blood

along" the veins toward the internal organs of the trunk, which he wished to warm and to excite to action.* Conversely, he would not try to drive cold blood in that direction. His idea in regard to heat is a good one, and shows that he understood exactly what he was doing, and that the utility of heat in restoration of persons was not in his mind a "theory of Dr. Lambert," but an idea of his own, especially as at that time (several years ago,) he could not have read anything about "Dr. Lambert's idea."

The following from Dr. Richardson was received after the preceding matter was in type, and the proof had been sent to him :

"I am very much obliged for your kindness in sending me the pages from your book, and the letters to the *Evening Post* which I had heard of but was unable to procure.

I should like very much to have you read the original article I published in the *American Journal of the Medical Science*, for January, 1867. You will there see that I base my treatment upon the interesting physiological experiments of my illustrious namesake, Prof. B. W. Richardson, of London, who injected hot blood into the coronary arteries of hearts with wonderful results.

My further study and experience in the subject has only confirmed my confidence in the value of heat as a means of resuscitation. In my lectures last year I applied the same principle to explain the cause of death from cold, viz., that the blood cooled upon the surface of the body when thrown into the coronary arteries acts as a sedative (relatively) to the cardiac muscular fibre.

Permit me also to suggest that whilst the blood remains fluid, (which condition may be retained for some hours inside the closed vessels,) blood could probably be forced through the heart by pressure upon or injection through the veins, independently of all car-

* It is, however, a question how much the blood would be driven inward towards or into and through the heart unless it should beat; the inward impulse of the blood might excite the heart to action.

diac pulsation, because the valves all open *in the direction* of the venous current. In the baby whose case I report, however, the heart beats were regular though very feeble.

With renewed thanks, I remain respectfully yours,

JOS. G. RICHARDSON."

The following letter was received to-day from one of the best known medical men of our navy, to whom the drowning of men is a familiar phenomenon. When such men give their minds to a subject something valuable will be sure to come of it. The request of a gentleman in his position, especially addressed in such a polite, scholarly, and thoughtful a manner as that which graces this letter, is equivalent to a command with which it will be a pleasure to comply :

DR. T. S. LAMBERT,

Dear Sir :—Taking much interest in your letters recently published in the New York *Evening Post*, and noticed in the papers of this city, on the possible resuscitation of persons after being recovered from the water, apparently dead by drowning, and the means you suggest for restoring consciousness. I desire to become better acquainted with your views in that connection. It has been repeatedly asserted by persons who have narrowly escaped drowning, that the sensation experienced upon the approach of unconsciousness, and of muscular exhaustion, was almost painless, and those who have been restored after becoming unconscious assert that while in the water they suffered but little pain and no agony, except that accompanying the fear of death during the first moments of their struggles. There can be no doubt that the glottis [the opening from the windpipe into the throat,] is closed the moment that the mouth can be no longer kept above water. Will not, however, the glottis be again opened, and water enter the larynx when it is beyond the power of the drowning person to longer hold his breath, and when relaxation has taken place ? One and a half minutes is a long time for a healthy person, in a calm state, to hold his breath, and taking

into consideration the high state of excitement and violent muscular exertions during the struggles for life, the time must necessarily be much shorter, and no time at all can be allowed should the drowning person be strangled and spasmodic cough ensue on account of small quantities of water entering the mouth or nostrils, and touching the glottis during the struggle. * * *. Do you think that death will take place in water covered with a thick ice sooner than it will in warm or moderate weather? I remember the case of a lad who had been about an hour in water, covered with ice about eight inches thick, the air at the time was not down to freezing point. Do you think that in such a case the means suggested by you would, if applied, be successful in restoring the drowned person?

This subject is one of vast importance, claiming the closest attention and investigation of medical science, since, should your theory prove successful in practice, many valuable lives can be saved that would otherwise be lost. Hoping to hear from you soon, * * *

A lay gentleman asks, "Is it true, as I have frequently heard it asserted to be, that when persons are drowned all the facts of their lives pass as a panorama before their minds? If so, does it not prove," etc., etc.

The above letter indicates both a profound interest in the subject, and very properly a suspended judgment.

It would be easy to answer yes, or no, to his questions, but such answers would not be satisfactory. Is pain felt in drowning? and the inference, If not why not? Do the facts of his life pass before a drowning person? Why does he appear to himself to live for centuries in that moment? Does he hold his breath, or is it held unconsciously when drowning? What takes place when consciousness fades? Can water then run into the lungs? and the like questions involving the deepest facts of the nervous structures, can better, indeed can only be plainly answered after an explanation of those structures has been given. To this,

therefore, I will proceed, and answer the above and other questions as the facts underlying them are brought to light.

Another reason for the particular discussion of the structure of some parts of the Body is, that although all authorities agree that suffocated persons can be restored if proper efforts are made immediately after animation is suspended, yet, as the absolute or scientific truth in regard to the time during which life may be suspended, is not yet attainable, nor can it be instantly, I must try to induce a scientific faith in the probable truth, such as shall test it thoroughly, plucking away doubt, the essential taint and default of all faith and belief and transforming these defective into the certainty of indubitable, victorious knowledge, with its applications plain, easy, and certain;* otherwise there will be partial tests, and of course failures, bringing reproach unjustly upon the cause.

To attain what is so desirable, since hope however strong, assertion however positive, and opinion however great its authority, will not produce this tenacious, experimenting, observing, deducing, scientific faith, and as only logical arguments will do it, it becomes paramount in importance, eliciting the strongest proof of any but the crucial fact, to inquire:

Is there anything in the nature of man's structure or of its functions, of his constitution or of its properties, that militates against the restoration by the "heat method," of persons drowned, or otherwise suffocated, or of those who are frozen? On the other hand, does not the nature of every part of the body, does

* Columbus is an illustration: He was not admirable because he discovered a new world, but because—governed by his faith and opinion that the World was round, and that the same ocean that laved the Western coasts of Europe must wash the Eastern Continent,—he went to search out a new route to the Eastern Shores of the Old World, which, until his death, he thought he had found. Though his idea was not true, yet the truth came from the search, and the faith became knowledge. Indeed, to correct faith is often more important than to confirm it, in the same manner as the destruction of weeds prepares the ground for wheat.

not every analogy, and every rational deduction, indicate that all such persons live for a long time after they are usually supposed to be dead, promising success to every proper effort for their resuscitation ?

I more readily enter upon this discussion because numerous letters like the above, make evident the fact that many intelligent, progressive, medical men take a deep interest in this subject, while, knowing as I now do the questions which many ordinary readers ask, I can fairly promise them that my treatment of the subject shall not be tedious but interesting also to them ; particularly as I shall not hesitate at any time to step a little aside from the direct path, to look at a flower attractive by its beauty, or to gather a fruit of especial practical value. The only objection to this is, that the field through which our path leads is so very rich in both flowers and fruits, that it may be difficult to resist the temptation to go astray too often or too far.

In plain words, to interest the reader, to make him receptive of the facts presented so that he will readily remember and apply them, various happy illustrations must be introduced ; and if any of these have important practical relations to life, no harm can result. Let it also be remembered that what may appear to be digressions may not in this case be such. The points to be explained may be dependent upon subordinate ones, and these upon others. The foundations and the scaffolding of a house, though not seen when it is finished, are essential to its structure. A road which goes down into a valley may for a brief time cut off our view of our journey's end, but when we rise again we find that it has all the time been advancing us upon our way. The reader will find, if the writer does not mistake, that his progress toward the goal of his wishes has been continuous, and most profitable to himself, and in more ways than one, especially if he considers that some of the ques-

tions asked and explained, and in which the ordinary reader is as much interested as anyone, involves some of the most profound problems of human life.

I will say to the ordinary reader, also as an apology to experts, that I shall always, when I can, use expressions that will be understood by every reader, however awkwardly they may look or sound to those proficient in the science. Again, any doubtful idea will always have a qualifying word, but I shall not hesitate to present an idea positively, nor to use an expression, simply because it is new. I shall try to relieve the discussion of the technical, the abstract, the dry and the tedious, and to imbue it with practical interest. If I succeed in this, considering the nature of the subject, and that it involves the deepest physiological problems, in the end I shall be excused for any short-coming by those who will appreciate the difficulty of the task.

Part II.—Subjective Arguments.

THEY ARE NOT DEAD.

INTERESTING DESCRIPTION OF CERTAIN PARTS OF THE BODY, DEMONSTRATING THAT ITS TISSUES, PASSIVE AND ACTIVE, (BONY, GRISTLY, SINEWY, SECRETORY, MUSCULATORY, NERVOUS,) ARE FROM THEIR NATURE, AND AS IF FROM DESIGN, RESTORABLE AFTER BEING DROWNED, EVEN FOR A LONG TIME.

The numberless repetitions of the same parts of the Body, (four hundred and fifty muscles for example,) curi-

ously and compactly arranged to occupy the least possible space, suggests a very complex structure. Fortunately we need not now study the numerous details of structure of the Body on one hand, nor of the elementary composition of the Tissues on the other, hence

OUR FIELD IS SIMPLICITY ITSELF.

All parts of the Body are constructed of only SIX TISSUES, or substances, in such a manner that each part has only those powers or properties possessed by the individual Tissues of which it is constructed. Example : The Stomach being constructed of four Tissues, it has only the properties of those and none of the powers of the other two.

Whoever, therefore, understands the SIX TISSUES, what they can and cannot do, and how to make them do their best and worst, understands pretty thoroughly for every day purposes, and fully for present purposes, the entire Body, its needs, and how to satisfy them ; and especially its relation to restoration in case of drowning.

THREE TISSUES ARE PASSIVE.

The (1) *Bony ;* (2) *Gristly*, or cartilaginous ; and (3) *Sinewy*, or fibrous.

These not only form the frame-work called the skeleton, but the last named Tissue serves as a frame-work for the most flexible and delicate organs of the Body, giving to them their passive strength, and binding their several parts together.

The first two named and their characteristics are readily recognized by everyone, and so are those of the Sinewy Tissue, when it is in the form of ligaments or tendons. It is not as easily recognized when its delicate fibres are wrought or grown into curiously and variously shaped mesh-

es, to serve as a framework of the skin, stomach, kidneys, liver, muscles, brain, etc., etc., to contain and protect their blood-vessels, nerves, etc.

Fig. 1

Fig. 2

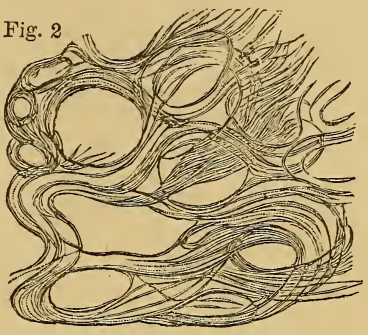

Fig. 1 represents a portion of Sinewy Tissue with its fibres pulled apart. Fig. 2 represents the same Tissue surrounding spaces from which their natural contents have been removed. The Tissue in both cases is much magnified.

It is noteworthy that this Tissue is in two varieties: the white inelastic, and the yellowish elastic, which plays a very important, usually unrecognized, part in breathing, and is of vital importance in respect to restoration by artificial respiration of those suffocated by drowning or otherwise. *

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* The character of this Tissue, and of that of the gristles in a horse is judged by the jockey by grasping and compressing the ear. If elastic it indicates a good constitution, especially of the lungs—"good wind" as the expression is. This trial is usually the result not of understanding the reason for it, but simply of experience. In man it is an equally good index that if a heavy ring does not "sag" the ear the person has a good constitution. The temperature of the ear is also at the same time noticed by the jockey, and indicates to an experienced person the present health of the horse. It is not generally known by the laity that a variation from the health point of one degree of temperature in the mouth or arm-pit of man, indicates that there is ill health in some organ, while *vice versa*, of course, ill health of any organ *always* affects the temperature of the entire Body. This is often, therefore, not only the best, but the only means by which the fact of incipient ill health can be known, although the organ in which it exists may not be suspected. A continuous variation of temperature from the standard is of vital consequence, indicating, if not otherwise observable, hidden disease, which should be sought. Healthy standards of Temperature vary in different sections. In Maine it is, for example, in man one degree higher than in New York. Whether this is true of horses, and of other animals, I do not know. It is an interesting question, and I shall be obliged for any information thereupon.

The Figs. below show highly magnified fibres of Yellow Sinewy Tissue, not parallel like the white, but branched curly and irregular.

Fig. 4 shows it around the exceedingly magnified air spaces in the lungs. If air is drawn into these spaces this elastic Tissue is stretched ; when the in-drawing power ceases to act, the large amount of this Tissue in the lungs will, like India-rubber, press the air out of them, not completely while in the closed chest, but if it is opened, so completely that the lungs become small and considerably firm. Out of the chest the lungs can be fully distended by blowing or drawing air into them, and then the elastic force of this Tissue in expelling the air can be realized, and also that the perfection of breathing depends upon the perfection of this Tissue. This topic will again come up

Fig. 3. Fig. 4. Fig. 3

Fig. 5 represents distended areolar Texture of Sinewy Tissue, often in this form named Connectory Tissue, because it loosely or closely connects between all parts of the Body, the spaces varying from the size of a mustard seed to that of an egg. The dense fibres of the true skin become less dense, at its lower portion, as can be seen at the "flesh side" of any piece of leather, until the meshes become areolar texture, and thus finer or coarser extend through all parts of the Body,

Fig. 5.

in such a way that all its Sinewy Tissue, dense or areolar in texture, is connected. Butchers sometimes introduce a pipe into a piece of meat and blow air into its areolar Texture, giving it the appearance of being fatter than it is. These spaces are always moist ; when the moisture increases it produces general dropsy ; even when small in amount it sometimes settles to the feet, which swell ; if the person raises his feet, or lays down, the fluid will return.

Fat is a secretion into microscopic sacs, bags or cells of Secretory Tissue, which are deposited in the areolar spaces of some parts of the Body.

Both varieties are exceedingly strong, binding the parts of the Body with a strength hardly realizable. They are the strongest of all organic substances, much exceeding in strength any hempen or other rope of the same size. Leather is simply tanned Sinewy Tissue; the Indians make the strongest thongs and their bow-strings from untanned sinews; the strings of violins, and of the like instruments, and called cat-gut, are made of the sinewy tissue of the entrails of animals.*

All these Tissues, being more than half the weight of the Body, in health undergo changes very slowly, and need very little blood. All three are practically the same in

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* As this strong Sinewy Tissue binds the head to the bones of the neck, and also binds them together, the neck is rarely broken in hanging. Nor is there any rupture nor injury, at least with rare exceptions, to the spinal cord of the part (pith of the neck). Nor is there any breaking nor dislocation of its bones, as is supposed to be the case, at least with rare exceptions.

When death is sudden in hanging, it is owing to the shock, jar or concussion of the delicate Nervous matter of the brains—caused either by the sudden check given by the rope to the falling person, or by the sudden jerk if the person is twitched up by a falling weight. If the person is simply hung by being let down or drawn up slowly, and without a jerk, the rope merely chokes or suffocates him by preventing the air from reaching the lungs. Suffocation—which will usually require considerable time in this case, as the air is often imperfectly cut off—is indicated when the heart beats for a long period, as it did in Hunter's case. Then life and a probability of restoration may and usually does continue for a long time. His life was doubtless not extinct when he was taken from the prison, nor for a long time after. Self-hanging is seldom anything more than suffocation, and thorough efforts should be made for the person's restoration, (see hereafter). The pressure of the rope upon the veins of the neck, may also cause congestion of the brains, this is often the case. This makes another complication to be considered.

The question may arise when a man is sentenced to be "hung until he is dead," How long is this? How shall we know when he is dead? Perhaps a more serious question may be, Has the Sheriff any right, under such a sentence, to let a man fall, or to jerk him up, killing him by the shock and letting him hang long afterwards? It is a barbarous act at best, and should certainly be done legally or not at all. The French guillotine or the Spanish garotte has the advantage of being certain as to fact and time, and either is less cruel than the usual hanging. The Military Method is the most gentlemanly and the best of modern times. The heathenish way of the ancients by poisoning, as witness the dying of Socrates in the midst of his friends, is the best of all if killing at all is necessary.

whatever animal they are found. What of life they have, if it be life at all, suffers no detriment from the suspension of animation for any length of time in the animal upon which we can experiment. Why should they be injured by a similar suspension in man for a few hours or days ?

When these Tissues are injured a decided change occurs. Great activity is seen in their immediate vicinity, and in distant organs related to their needs. They need blood, also rich in nutrition, namely, the tissue building elements ; hence the pulse and respiration without fever, and a hearty appetite for hearty food must be quickened. In marked contrast, if the hip or thigh is involved, the necessity for quiet in those parts commands, without harm, for days or even weeks or more, the suspension of the usual daily movement of the bowels ; the process of repair thus goes on apace, unless, as is too frequently the case, Ignorance frustrates Nature by ordering gruels, antifever doses, powerful purgatives, etc.* From other causes, women are often so similarly situated that they should be undisturbed for many hours or days, being permanently injured by the haste of ignorant or criminal attendants, although many days have elapsed. In these cases, when the movement of the bowels is postponed by nature, it will be perfectly natural or healthy when it occurs.

These changed activities in relation to the injured Passive Tissues, occur uniformly throughout all animal life where these are found. Are they not then of one nature everywhere, and in man as in the animals subject to the same laws in regard to drowning, etc. Such adaptation of means to ends, such previsions and provisions, rightly the

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* Nature alone is always as good as, and usually better than, when in a forced partnership with Ignorance, except she is allowed to do all the work while Ignorance cunningly takes all the credit.

constant theme of the enthusiastic surgeon, suggest that drowning, and other modes of suffocation to which man is naturally very liable, will not be exceptional accidents, for which no provision has been made. Especially when we learn that a portion of a nose and of an ear have been carried a long distance and "reset" successfully; that a tooth knocked out in boyhood was replaced and remained in its place for forty years; that a portion torn from an eye-lid was frozen on the way to the doctor, yet, as its motto was "never say die," it to this day may repeat the words of Webster "I still live;" that pieces of skin were transplanted from thirty persons to a lady's head denuded of scalp; and that other like experiments, equally instructive, are by accident daily occurring,—we perceive that drowning cannot mean immediate death to the Passive Tissues. Life either does not exist in these Tissues at all, in which case drowning will not be adverse to them, or if it exist in them it will persist for a long time. We also perceive by the cases instanced that life pertains to each portion of Tissue in which it exists at all, in short that it is a property or characteristic of each atom of the Tissue to which it belongs, and that it is not necessarily killed out of a portion of Tissue merely because this is separated from the other part.

THREE TISSUES ARE ACTIVE.

The (*a*) *Secretory;* (*b*) *Musculatory;* (*c*) *Nervous.*

I will here explain that the terminations *ory* and *ion* are correlative, for example, Circulat-*ory*, means concerned in circulat-*ion;* Mot-*ion* is performed by mot-*ory* Tissue. Secret-*ory* Tissue produces Secret-*ion*. Musculat-*ory* Tissue is concerned in Musculat-*ion*, etc. The termination *ory* names that which does, and *ion* names that which is done. Respirat-*ory* names that which does, and Respirat-*ion* names that which is done by the Respirat*ory* parts.

All that is done in or through the Body, is accomplish-

ed by these three Active Tissues, that is to say, there are only three general kinds of activities performed in or by the Body. This will to the novice seem to be a singular, and incredible statement; yet wonderful as is the fact, it is entirely true that all which is done in or by the Body is effected either by *Secretion*, which means the formation of peculiar fluids by different varieties of *Secretory Tissue*, all acting in the same general manner under the same law; or it is effected by *Musculation*, which means Motion produced by action of *Musculatory Tissue;* or it is effected by *Gangliation*, or *Nervation*, which mean the modes of action of the *Nervous Tissue*, (the *Gangliatory* and *Nervatory Tissue.*) Such a marvellous simplicity of means for gaining such varied ends, if it surprise the student, may well encourage him in his study.

Observe that these three forms of activity are very distinct and different from each other; while the varieties of each are very similar, both in mode of action and in results. Of course there is an equal distinction between the Tissues, and an equal similarity between the varieties of each.

(*a*). *Secretory Tissue.*

Its beautiful structure, its marvellous action, and especially its hygienic importance, usually not more than partially recognized, make this one of the most, if not the most, interesting and practical of the Tissues. Forming the surface of the skin, and the lining of the air passages, it is exposed to all the vicissitudes of the weather, and as the lining of the digestory canal it is exposed to the still worse action of all the impositions which most persons, very unwisely, inflict upon their stomachs. It is essential not only to respiration and digestion, but, in fact, in one variety or another, to every function of the Body; hence the dis-

eases to which we are subject, and the wellness which we enjoy, are dependent directly or indirectly more upon this than upon all the other Tissues together. Therefore the instruction which the study of it will afford, not only upon the matter in hand, but upon kindred matters of great practical consequence, will well repay the diligent attention of every reader.

To fully appreciate its exquisite delicacy, and its admirable arrangement, in very many instances the microscope is needed. Yet, with the aid of the close attention of the ordinary reader, I will try to make this Tissue understood by him, especially in its practical aspects.

THE CHEMIST OF THE BODY.

It may well be thus called, since, by its several varieties, it produces or secretes all the liquids of the Body, even the blood itself being the result of the actions of this Tissue. Yet we usually and correctly speak of the secretions as being produced from the blood.

Wherever any liquid is needed, there, or communicating therewith, a corresponding variety and quantity of this Tissue is found, often very curiously and compactly arranged to occupy the least and the most commodious space. This appears to give complexity to organs thus constructed, while in fact Secretory Tissue is very simple in structure and action.

It draws from the blood the materials for its self-formation and repair, as all the other Tissues do, and it also draws from the blood the materials which it secretes, or forms, into bile, gastric juice, tear fluid, saliva, etc., etc., according to the variety of tissue at work. How this secretion is performed no one as yet knows. No other Tissue can produce any other substance than itself. This marks

the distinguishing characteristic, utility, and need of Secretory Tissue.

ANOTHER USE.

It is a surface Tissue, in a double sense ; it is so thin that it is merely a surface, so to speak ; it also forms all the surfaces of the Body, covering all the organs, and lining them and their tubes ; thus it protects the parts below it and upon which it grows, and to which it adheres. It does not send any fibres down into the parts below it, nor do they send any fibres up into it ; it merely adheres to the parts upon which it grows, being a distinct Tissue by itself, and unmixed with anything else ; so that it can be easily and cleanly peeled from the adjoining parts, as is seen in case of the water or blood of a blister, which raises the scarf skin, or those outer layers of the skin which are its Secretory Tissue. This also shows that neither nerves nor blood-tubes, nor any fibres enter the Secretory Tissue. The experiment often tried by boys of thrusting a pin or needle through the outer layers of the skin without causing pain, or starting blood, also shows that there are neither nerves nor blood-tubes in the Secretory Tissue. Indeed, it will require but little stretch of the imagination to perceive that all the Secretory Tissue in and forming the surface of the Body could be stripped from the parts to which it adheres without pain, or a drop of blood, and leaving all the other Tissues undisturbed. This essential peculiarity and independence of the Secretory Tissue will be better appreciated by noticing

ITS STRUCTURE.

Secretory Tissue is a very thin, delicate substance, a mere film, thinner than the side of a soap bubble. Indeed, thinness and a surface seem to be its essential characteristics.

Fig. 6.

Fig. 7.

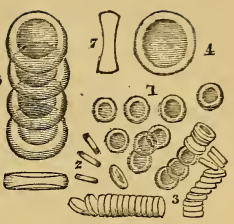

Fig. 6 is a beautiful *plan* or partially imaginary representation of (1) a single layer of cells, resting upon (2) basement membrane, adherent to (3) the fibrous sinewy true skin or membrane, containing blood tubes and nerves not represented, (4) arteries, veins, and capillary net-work between them.

Fig. 7. 1, 2, 3, blood-cells much magnified. They are inclined to adhere, as at 3. 4, 5, 6, 7, the same more magnified showing 5, the convex, and 7, the concave surfaces that the same cell will exhibit at different times. Their semi-transparence is show at 6.

Their true size can be imagined when it is known that in every drop of healthy blood there are (2,800) twenty-eight hundred of them, and a variation of a couple of hundred either way will be always attended with ill health, and *vice versa*. Dr. Draper says, "twenty millions die at each pulsation!"

Fig. 8.

Fig. 9.

Fig. 10.

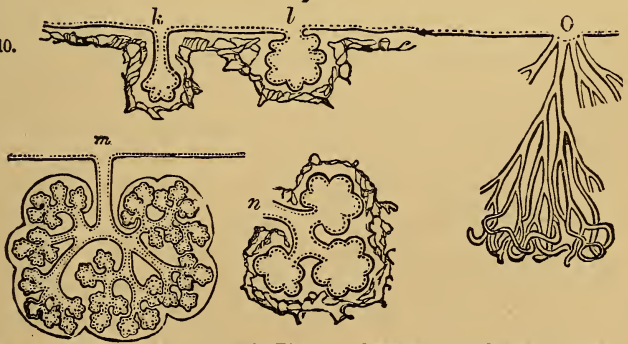

Fig. 8, a ruder plan of the parts in Fig. 6; *a*, basement membrane; *b*, cells; *c*, fibrous sinewy under-structure.

Fig. 9, the same, forming a short tube at *g*; a pouch, crypt, or follicle at *h*; and at *i* a coiled long tube.

Fig. 10, *k*, *l*, simple follicles, with sides a little corrugated; *m*, *n*, the same branched (racemose); *o*, outlet of many tubes, perhaps merely branched, perhaps from many racemose follicles; different modes of increasing surface.

It is found in the form of an extended sheet, or of pouches or follicles, or of tubes straight or coiled or branched, often with follicles about them, and then looking, when isolated, like the bark of the trunk, branches, twigs, and leaves of a tree ; but the larger part of the Tissue is found in the form of closed cells or sacs of different forms in different varieties, and filled with the liquid which it secretes.

These cells are attached to the extended or to the tubular membrane, which is then called basement membrane. The cells grow up from this until of mature size and full of secretion, when they rupture yielding their contents, passing away themselves and making room for others to grow up in their place. The rapidity with which this takes place when the Tissue is healthy, active, of a proper temperature, and properly supplied, will exceed the belief of those who have not seen the work go on under a microscope. Millions of these cells will spring up, mature, rupture, and die in a minute ; and though each cell is microscopic and can yield but a speck of secretion, too small to be seen by the naked eye, there is such an immense number of cells at work that the secretion anywhere will be as abundant as the need is great.

In the outer, or scarf skin, there are several layers of Secretory cells, those next to the basement membrane being plump, full, and soft, while the outside layer has become dry, a mere dead scale, effete and ready to fall away.

We little think that the beautiful complexion at which we look with admiration is dead matter, that we are enclosed in a thin coat of dead matter, and also that the streaming hair or the graceful ringlet that enchants us, is but effete dead matter, from which life has forever departed. Truly there is beauty in death.

The number of layers of cells in a "callous" is very great, and also in a "corn ;" the layers here are arranged

as a cone, and the lowest being microscopic in size and hard, the cone is very sharp, and causes great pain when pressed upon the tender parts below. Elsewhere than at the surface of the skin there is but one layer of cells. A very delicate layer of a different variety from those of the skin lines the mouth, nose, eyelids, etc.; and other more or less delicate layers cover or form all other surfaces in the Body.

What was said of the secretory cells being attached to basement membrane has one exception—in the blood-cells. These floating in the blood can draw their materials direct from it, hence they do not need an attachment as other cells do. (See Fig. 7.)

The nerves beneath are acted upon with great sensitiveness through the Secretory Tissue covering them. If objects should touch the nerves directly they would cause pain—it is best as it is. Witness the exquisite action when water or other liquid, or a solid substance, touches the outskirts of the throat threatening an entrance to the wind-pipe; the nerves there covered by the delicate Secretory Tissue instant telegraph the danger to the head-centre having charge of such matters, and by a return message the wind-pipe is peremptorily closed, and the whole breathing apparatus is suddenly brought to a halt, until the danger is past. (The particulars hereafter.)

SECRETORY TISSUE IN PLANTS.

But if some one objects that the marvelous work of the Secretory Tissue is not independent, but is influenced by the nerves just below it, he may be referred to the varieties of Secretory—the only active—Tissue of Plants.

It is the same, except in variety, as exists in animals, and in plants it cannot be influenced by nerves, nor associated at all with sensation, emotion, consciousness, nor volition. Nor more is it in man, nor is there more nor any

need that it should be. Upon what does it depend in the plant for its action ? Upon its constitution, health, its proper temperature. and upon a flow of rich sap, the blood of plants, into its immediate vicinity.

Change the word sap into blood, and the precise conditions above stated are requisite for the action of the Secretory Tissue in man.*

SECRETORY TISSUE VEGETATIVE.

So much like the Secretory Tissue of plants is that of animals and man, that in the latter it is often, and very properly, called the Vegetative Tissue ; and as in plants we see its action to be intermittent, so is it in man. Witness the action of the Secretory Tissue forming the innumerable tubes in the sides of the stomach, and which pour their secretion into it to assist in the digestion of certain kinds of food. This secretion is needed only when this food is needed and eaten.† The intermittent action is not self-regulated by the Secretory Tissue, which is always ready to act if the conditions exist, but it is regulated by the flow of blood which, as has been mentioned, and will hereafter be

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* The constitution must be chiefly inherited, it can rarely be improved after birth. Its health must be promoted and preserved. Its temperature must be cared for, and in particular if this Tissue is enfeebled by exposure, ill health, or by poverty, the person must be warmed and kept warm by being well clad, sheltered, and fed by heat-producing food, if he can digest it, if he cannot, he must be artificially warmed ; the young, the feeble, and the poor need heat, while many well people jeopard their health by allowing themselves to become chilly. This is a great mistake. The Secretory Tissue can usually receive much heat with great profit, as witness the value of heat to plants, while the heats of summer are also good for man and animals.

† If the blood be needed anywhere for secretion, as it is in the stomach at meal times, other parts should not then be stimulated into activity also requiring extra blood. A man has no business when he is eating to place his paper nor his accounts before him, nor to think of his money matters. He might as well pull a paper out of his pocket when drowning, and read the market quotations. Eating is one of the most important acts of the day, and for greatest profit should be enjoyed without distraction.

shown in particulars, is controlled in accordance with the needs of parts perhaps quite distant from the part which controls the circulation.

Some parts of the Secretory Tissue intermit action for hours every day, and in some animals for months, and in plants for even thousands of years, and again resume activity when the proper conditions exist. Witness the wheat taken a few years ago from an Egyptian mummy, that, when sown, grew and "went to seed," minding its business like any other respectable Secretory Tissue.

Now, as submersion does not induce death in the Secretory Tissue of plants, is it not a legitimate deduction that the Secretory Tissue in man cannot be drowned ?

It should be noticed before leaving this part of our subject, that, as different plants and different parts of the same plant require different degrees of heat, so do different animals and different varieties of Secretory Tissue in the same animal require different degrees of heat.

SECRETORY TISSUE RELATED TO LIFE.

When this Tissue in plants is torpid life is no longer manifested, but, as soon as heat is restored life abounds. This Tissue is common, and the only one that is, to everything that exhibits life,—plants, animals, seeds, and eggs. *Vice versa*, life is seen only in the presence of Secretory Tissue. This Tissue may be found in abundance where no other is, but the others are never found without it. The five other animal tissues are not found in the plant, seed, nor egg, nor is the woody Tissue of the plant found in the animal, seed, nor egg. Again, the Secretory Tissue must be produced by Secretory Tissue, but all the other Tissues may and do arise from it. In the newly-laid egg the only Tissue is a minute cell of Secretory Tissue. In three weeks' time

heat alone has caused the development from this of five more Tissues, and the hatching chicken has six.

Also by the heat of the sun the woody Tissue of the plant is evolved from the starting point—Secretory Tissue.

It is thus seen that in the seed and egg, Secretory Tissue alone bodily descends, as the germ, from parents to their offspring, bringing life, longevities, identity within limits, and all the other characteristics that descend from one generation to another. True, this cell is too minute to be seen by the naked eye, and at first view seems to be of little consequence, but the microscope reveals the marvelous and almost incredible fact that in these small bounds are, yes, millions of components, each of which is of itself a compound, giving abundant opportunity for all the varieties and individualities that facts before us show in the same kinds of plants and animals, and in man, proving that within limits "like begets like," while within limits individualities are also produced. The mother's Roman nose appears in her sons, that of the father in the daughters, and although it is not seen at birth it is potential at that time, and will be seen when its cycles are completed. A doctor at 78 had disease of the prostate gland, so did his brothers about the same age ; their father and grandfather had the same disease between 76 and 80. It was latent all the previous years, but was constantly progressing or evolving.

Also, as we see in plants that some are longer lived than others quite as vigorous while they live, so is it with animals and with man ; and as some of the Secretory Tissue in a plant is longer lived than in other parts—the blossom leaves being much shorter lived than the green leaves,—so in man, great differences of longevities may exist in the different varieties of Secretory Tissue in different organs, or in different portions of Tissue in the same organ. Hence, one part of the Secretory Tissue of an organ may die early and

another part live to old age. It is the inheritance of vigor and long life in the Secretory Tissue which is the main point in health, happiness, and long life, provided also that with these goes the few grains of common sense that cares for health, and that acquires the intelligence that knows how to care for it. Hence, there may be a great difference in the restorability of different persons after being drowned. The Tissue of an important part may be near its death age, of course in decrepitude, and not able to recuperate, although all other parts are yet young, and the shock of drowning will be more than it can bear.

Inheritance is well illustrated by the hair, the bulbs of Secretory Tissue of which in some parts of the scalp die early, while other bulbs near by live on. It will be found in case of the male, that "it was just so with father," or "with mother" in case of the female, as a rule; if not so with either of them it was so with some other ancestor. Baldness of fathers usually follows sons, that of mothers commonly follows daughters.

It is also observable that long-livedness is inherited,* since although some of those who are naturally short-lived may be and are born of those who are long-lived upon both sides, yet those who are long-lived do not spring from the short-lived, with the very, very rare exception when the peculiarities of the parents exactly compliment each other, as is also infrequently the case when great talents are seen in a child of mediocre parents. The inheritance of long life, when it exists in any case, is also easily recognized and measured in the mature. A measure of six inches through the head just in front of the upper part of the ear where it

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* Forty questions were put to all those over 90 in Great Britain, so far as known, two only were answered alike.— (1) all were early risers, (2) all came of long-lived stock.

is attached to the head,* indicates ninety years old ancestry on the father's side of the house, while five inches measure from the bridge of the nose to the orifice of the ear will not be found unless ancestors on the mother's side attained the same high age. A trunk more than one-third the height of a person indicates also high age on the mother's side, while an ample circumference of the chest indicates the same blessing inherited from the father's side. Capacious nostrils, a long upper lip, large lobes of the ears, fingers well webbed between, and many other positive indications of inherited longevity might be mentioned as coming down through the Secretory Tissue germs. †

With all this closeness of relation exhibited between Secretory Tissue and life,—and not a tenth part of the argument has been shown,—is it not fair to deduce that life is a property of, or else the name of phenomena exhibited by, Secretory Tissue ?

As the Secretory Tissue has no consciousness, and is not represented in consciousness, the consciousness or memory

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* The Compositor suggests that I insert an explanation of how to make this measure. "Callipers" are the "correct thing" to use. As a substitute, curve a soft wire (if hard or springy heat it,) into the form of this capital letter C, put the ends against each side of the head, and taking them away without changing their distance from each other, place them over an inch measure. A very useful measure, especially in case of children, is obtained by encircling the head with a hoop, band, (India-rubber is good,) or cord, in front let it cover the lower margin of the eye-brows, and behind extend across the "occipital protuberance," a roundish prominence of bone easily felt at the lower back part of the head where it meets the hollow of the neck. From this circle (it can also be made by pushing down a large hat to said points,) measure the perpendicular distance to the orifice of the ear. This distance is usually called "Powell's Life Line." If an inch or more in length, especially if the head is broad, there is a great promise of a long and strong life, if not more than half an inch in length, the child will seldom if ever live through the diseases of childhood. The meaning of these measures will be appreciated when we notice the Nervous Tissue and its measures.

† As this matter of "Indications" is so generally and so deeply interesting, the reader is referred to an advertisement of "Biometry, &c.," at the close of this book.

of the identity of generations cannot pass from one to the next, and the idea nearly, if not entirely uniform in drowned persons, that while they were drowning they remembered having lived ages before, is an illusion. Consciousness of identity is wholly individual, depending upon the development and activity of certain parts of the Nervous Tissue, reaching back earlier in personal history in some persons than in others—some remember themselves as far back as before two years of age, but it cannot reach back to the germ, much less pass or communicate through that gateway with antecedent progenitors. Consciousness and identity are frequently out-lived by the Secretory Tissue, as we often see in old age, while they never out-live that Tissue.

Want of consciousness which most people regard as indicative of death, is therefore no sign that life is extinct.* It has been abundantly shown by this argument that consciousness is only one of the very numerous facts for which life is essential, while life is not the least dependent upon consciousness, which is lost when a person faints, and when he sleeps (why it thus wavers we shall hereafter see.) But life abounds in plants and holds its sway in animals unaffected in the least degree by want of consciousness. It is very desirable, therefore, to thoroughly eradicate the common, erroneous, and very unfortunate idea that life and consciousness in man are closely co-associated, and that there is some-

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* In the last number of *Nature*, the most authoritative scientific publication of the day, a writer of an extended article upon inherited memory asks, "If something analogous to making an impression upon the brain really takes place whenever we commit anything to memory, is it not possible that if the impression be deeply fixed, the impressed brain may be transmitted by the parent to the offspring, which thus inherits its ancestors' memory?" Not at all, because the brain itself is not inherited, only the Secretory Tissue is, and it inherits—as the case may be—the power of producing a superior or an inferior brain, which may or may not instinctively possess, or readily acquire the knowledge in question, but the "memory" of anything cannot be inherited, nor pass from one to another.

thing appalling and significant in death in the mere fact that in case of drowning consciousness is lost, when the person is not only not dead, but is no nearer death on that account.

Now, as it is the nature of *Secretory* Tissue to be dormant for hours every day; as it seems to remain so without change for days if blood does not come to disturb it; as the buds of trees and as hibernated animals are warmed into activity by the heat of the genial spring; as flies, constructed mostly of *Secretory* Tissue may, after being drowned, be quickly resuscitated by the sun's rays, or heat from other sources; as the incubating egg ceases to develop when taken from the hen, yet, in a day or two, if put back or into some equally warm place, is again warmed into activity; as the eggs of the ostrich, turtle, etc., are hatched in the sand, their development being suspended for several hours each night, etc., etc.,—surely Secretory Tissue will not refuse to be resuscitated because a person has been drowned for a few hours or even days. In fact, since in some cases it continues to grow after death as often then shown by the hair, beard, etc., it will be quite proper to assert that *Secretory* Tissue cannot be drowned, indeed, it will be quite as well off in the water as it will be out of it.

(*b.*) *Musculatory* (*Muscular*) *Tissue.*

It is a wonder to the most expert how much of what is done in and by the Body of man and of animals is accomplished by means of, or in connection with, Motion. Whether we walk or talk, wink or drink, wheeze or sneeze, whether we breathe, digest, or circulate blood, whether a bone is to be repaired or the thoughts are to be quickened, whatever is done in the Body is always attended with motion. The marvel grows when we consider that all these, and ten thousand other motions, are accomplished by one

simple Tissue, acting always in the same manner and merely arranged in various ways. This real simplicity in the midst of so much apparent complexity, is the constant theme of the admiring contemplation of whoever makes the motions of the human Body, or of any animal, his study.

This Tissue must therefore be very abundant, and found from head to foot. It does in fact weigh more than one-third of the entire weight of the Body. It is named the lean meat, but this also includes nearly an equal weight of Sinewy Tissue.

MUSCLE VIEWED BY THE NAKED EYE.

If the skin, and perhaps a layer of fat imbedded in Sinewy Tissue beneath the skin, is stripped from any animal, a large amount of lean meat is seen directly below, as in Plate 2. It appears to be very orderly, to be constructed of distinct parts named muscles, and to be connected with other parts of the Body, chiefly with the skeleton, by long or short, narrow or broad, tendons. It we notice a piece of ordinary cooked meat, the order is not so apparent, it appears to be a crude mass without form or comeliness, or any adaptation except for eating.

But in case of the cooked leg of a chicken, its beautifully shaped muscles are easily parted from each other, while they are also easily stripped up in one direction into shreds ; so indeed is almost any piece of cooked meat, the strings thus obtained being the fasciculi, hereafter described, of the muscles ; all of which have their use in beautifully producing the required motions of the animal by merely contracting or shortening, and alternately extending or lengthening in the lengthwise direction of the fibres of the lean meat or muscles. This action can be felt by grasping the front part of the upper arm midway, and raising and lowering the lower arm.

The stripes shown upon the red parts of the various figures indicate the directions of the fasciculi in the muscles. They are not usually parallel to each other as their contents are, but they are curiously arranged for the purpose of gaining celerity of motion, grace of figure or motion, or for economy of material, although the last is always sacrificed to either of the first two. Long tendons are seen extending down the arm and leg of plate 2, from the red or active parts of muscles to the hand and foot.

Often the action of the Tissue is not in the line of motion desired for the part to be acted upon. In that case the tendon must turn round a bone or pass under a ligament, as seen at the ankle and wrist of the figure of Plate 2. In such a case there is friction at the turning point. To reduce this an anti-friction bag, formed of sinewy Tissue, and lined with serous Secretory Tissue, and filled with serum (a very thin watery but glairy liquid) secreted in it, is placed at the point of contact, between the tendon and the part against which it moves. One of an hour-glass shape is found under the ligament at the front of the wrist, where the palm of the hand commences ; if the front part of this is pressed, its liquid content is pressed back, making in most wrists a little prominence, which if felt will be noticed to be full of liquid.*

MUSCLE VIEWED UNDER THE MICROSCOPE.

It is composed of microscopic cells, or closed sacs, having a cylindrical form, and filled with *musculo-plasm.* These cells are so small that hundreds of them would be required to make a speck large enough to be seen by the naked eye.

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* When one of these bags of liquid, which are quite numerous, especially about the hand, becomes enlarged and distended, it is commonly named a weeping sinew. It produces a remarkable weakness of the part, is easily cured, and should be at once attended to.

Each cell is complete by itself, and whoever understands one understands all the billions upon billions throughout the Body.

Fig. 11

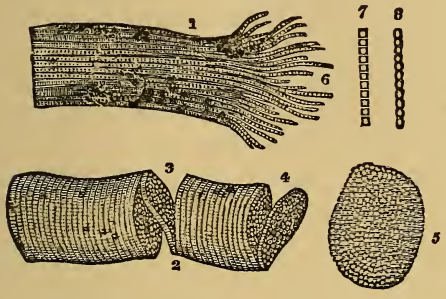

Fig. 11, a plan of Muscle-Cells. 7, 8, cells, end to end; 1, cells end to end and side by side; 6, same, spread; 2, 3, 4, bundle of cells, separable into discs, of which 5 is one. The form of the bundles is very irregular in the muscles. The size here is very much magnified.

These cells, and these only, in the Body, have the power or the property of contraction or shortening, and of extension or lengthening, but in the direction only of their length. Both of these acts inclusive are named Musculation. The cells when extended are about twice as long as they are broad. As they contract, their length diminishes, and their breadth increases, but not so much as to equal their diminution in length. That is, their entire bulk, if such a word is applicable to so small a thing, is smaller when they contract and larger when they extend. This is partly owing to their throwing out some of their contained substance or plasm into the blood when they contract, and taking up substance from the blood when they extend. To speak more correctly, throwing out the substance makes them contract, and taking up substance makes them extend. That which is taken up becomes new plasm, ready for action and change. That which is thrown out is effete matter, which, having changed, is no longer fit for use. The change of the substance of the plasm constitutes the power of action which exists in the cells of this Tissue.

Although the extent of motion or the power of any one cell is microscopic, yet if several thousands of them are joined end to end, forming what is named a fibrilla, the effect of the conjoined contraction of all of them will be apparent to the naked eye ; and if some thousands of these are placed side by side (covered by a delicate sheath of minute sinewy fibres, the bundle is named a *fibril*,) the force which unitedly they will exert is also observable. Hundreds of these fibrils placed parallel to each other in a bundle, and covered with a sheath, are named a *fasciculus* (or little bundle). Bundles of these covered with a sheath sometimes form a complete Muscle, and are so called, but oftener these bundles are but parts of large muscles, and are then called *fasces* (or bundles). Several of these covered with a sheath are named Muscles, of which again in bundles covered with sheaths the legs, arms, neck and other parts are chiefly constructed. All the cells in a fibrilla do not usually contract at once, but some are contracting and others extending at the same time, thus these maintain the contraction of the muscle as a whole.

The sheaths of the several bundles within bundles of a muscle extend more or less, in most cases, beyond the contracting cells, and, being condensed, form short or long tendons, which thus connect the cells with the parts upon which they are to act. In case of this Tissue being formed into rings, or canals, or pouches, as in the heart, stomach, and digestory canal generally, the ends of the fasciculi usually connect with each other without the intervention of any tendon or ligament.

This brief description of the structure of Musculatory Tissue is sufficient for our present purposes. I will add only that if microscopic motion simply is required in any part, single cells are sufficient. They are then called scattered cells. More will be said upon them.

It cannot be. Not only when a cell has contracted, it must extend before it can contract again, but when the cells in one muscle contract, other cells in other muscles must extend. This extension is not usually recognized to be as it is, and as it has been shown to be, an active work, but it has been allowed to pass as if it were passive, and has been named "relaxation." But when the muscle upon the front part of the upper arm is contracting to raise the lower arm, quite as much adroitness is required in adjusting the extension of the cells of the muscle of the back part of the upper arm, and which, by its concurrent extension, permits the lower arm to rise. This is better seen if we lie down or otherwise bring the arm into a horizontal position, and then move it, when we shall readily perceive that both muscles are and must be positively active. It requires as much training to execute well the extension part of musculation, as is necessary to perform efficiently the contraction part.

Very many of our motions are accomplished by the conjoint contraction of several muscles, or of parts of several, and the conjoint extension of an equal number of muscles or parts of muscles. In every breath more than one hundred muscles conjoin their musculations, a part of them contracting and a part of them extending at the same time. When by certain muscles the windpipe is raised, and the base of the tongue is firmly held, in order to close the small opening from the throat into the windpipe, it would not be seemly to have over a hundred muscles tugging at the chest to expand it, and to try to draw whatever was in the throat into the windpipe, when its natural opening was closed for the very purpose of keeping substances out of the windpipe. No such contradictory action is natural in the human Body, but the most perfect harmony exists in the action of different muscles which work together—harmony

both in respect to contraction and to the still more delicate work of extension. When this harmony does not exist in the respiratory process, distressing strangling occurs, or if it does not exist among the muscles generally, the most painful cramps or shocking spasms occur.

But the muscles cannot harmonize their own action with that of others. There must be a harmonizer, and as there are hundreds of groups of muscles to be harmonized, there must be many harmonizers or centres with which the cells of the muscles must be in communication, and by which they must be controlled. These cells cannot therefore be independent or self-active, but they must be dependent, excited to action, differing essentially in this respect from the cells of the Secretory Tissue.

If there is nothing to excite the muscular cells they may, will, and do remain dormant for hours and for days, awaiting patiently, and without thinking of suicide, until they shall be called into the activity for which they are useful.

INTERESTING EXPERIMENT.

One of the most beautiful experiments for the purpose of appreciating the harmonious character of musculatory action, and almost the only one in which the general action of Muscular Tissue can be watched by the naked eye, is tried by moving the flame of a candle to and from the open eye (blue or grey,) of a person.* The pupil will be noticed to diminish as the flame approaches it, and enlarges as the light recedes. A closer view of the iris, rainbow, or colored part of the eye, shows that there are in it beautiful rings of the Musculatory Tissue around the inner margin of the iris, demarking the pupil. From these rings straight fibres of the same Tissue are seen radiating like

* A brown eye does not so well exhibit the musculations.

the spokes of a wheel, only the fibres are close together, outward to the outer margin of the iris. As the light approaches, the ring fibres contract, and with equal steps the straight or radiating fibres extend. The instant that the light recedes all is changed ; the straight fibres contract and the ring fibres extend, enlarging the pupil. The motion of the flame backward and forward cannot be made so quickly that the contractions and extensions will not appear to be instantaneous therewith ; although there must be an instant of time intervening, it is so brief that it cannot be noticed by the observer.

To harmonize this work there must be a "head centre" to which reports are made, and from which commands are issued, and the celerity and certainty with which all this is accomplished is marvelous. Try the effect of changing the movement of the flame, and see if it receding can be moved so quickly toward the pupil that the centres which there watch over the double muscular action can be caught napping.*

Notice also that all this marvelous action in this exquisitely sensitive organ, no one more so, takes place without the least consciousness on the part of the person whose eye is observed ; he merely perceives that the light is more or less bright at different distances, but by his consciousness or by any sensation, he knows nothing of the muscular action nor of its control. When this unconscious control of the size of the pupil is partially paralyzed, the person realizes by the pain that light causes at one time, when it is too strong, and by its apparent dimness at another, when it is too weak, how much his enjoyments depend upon the unconscious superintendency of his Nervous Centres.

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* As this is a very practical experiment for explaining many points, each reader is earnestly requested to try it thoroughly, and more than once, that he may become familiar with its interesting phenomena.

THE "TIRELESS HEART."

(*See Plate 4 and its description.*)

Again, observe and compute the labors of the little busy heart, a hollow muscle.* It proves that in the kingdom of the muscles, as in social life, it is not the most pretentious but the most industrious that are the most useful and accomplish the most. True, at times the large muscles exhibit astonishing feats of power, but most of the time they are quiet. The heart beats night and day, perhaps for a hundred years, without apparent fatigue, and with so little jar, that many intelligent men have gone to their graves ignorant of having such an organ. Indeed it has been notable that in a majority of cases, any orator wishing to illustrate deep feeling by placing his hand over the heart, mistaking its locality, so little has it arrested attention, points out more nearly the position of the stomach; by the way, unintentionally expressing, perhaps, a truth.

The celerity of the flow of blood, and the magnificent labor of the heart, is not and cannot be allowed to be regu-

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* In fact there are two hearts in what the common eye regarding them externally sees but one. Each of these throws out at each beat (they act in unison) 1 to 3 ounces of blood, with a force that would raise it 2 to 4 feet. This equals 4 to 12 pounds per minute; 240 to 720 pounds (1 to 3 barrels) per hour; and 3 to 9 tons (24 to 72 barrels) per day and night. Double this to compute the action of both hearts, one driving the blood through the lungs, the other receiving the blood from the lungs and driving it through all parts of the Body, including a small branch of a blood tube leading into the lung to nourish it. The blood then returns through the veins of all parts to the first named heart, and starts again upon its round, passing through its entire course, or round, 12 to 21 times per hour, except as parts of it are removed, here and there, to supply the needs of the Body, and as effete substances from the various organs, or wholesome substances from the air, water and food are thrown into it; that is to say, the quantity of blood in health averages from day to day to be about the same in the same man, and averages to course through the Body 12 to 21 times per hour. (See Plates 4 and 6.)

The reason why the blood flows so smoothly and is so slightly retarded, causing no jar by its friction against the sides of the blood tubes, is that they are constantly lubricated with the glairy serous liquid secreted by the serous Secretory Tissue forming the inner surface or lining of the blood tubes.

lar. It must in fact have great latitude in order to satisfy the constantly varying needs of all parts of the Body. The heart must and does beat faster when we sit, than when we lie down, faster when we stand, and still faster when we run. Remember also the often varying needs of the Passive Tissues, and the greatly and constantly varying need of blood by the Secretory Tissue. There must, therefore, be and there are Nervous Centres which regulate the action of this organ.

ESSENTIAL USE OF OXYGEN.

Notice also, with very particular emphasis, that there is a double cause for variation in the circulation of blood about and among the Musculatory Tissues. The flowing blood not only brings to them their needed materials for use, but it takes from them that which they throw out as effete. The Secretory Tissue discharges from the Body its effete matter by way of its own surfaces; hence it needs only to be supplied with food and water introduced into the blood. But oxygen introduced into the blood through the lungs at each breath, is a great purifier, a grand disinfectant, a speedy scavenger, which, circulating everywhere in the blood, seizes upon every effete particle thrown out by the active Tissues into the blood, and instantly combining with it, burns or oxidizes it, producing then and there, from what would be poisonous if allowed to accumulate, new and harmless compounds which are soon discharged from the Body. At the same time that the oxygen performs this essential duty it produces in part, and at the spot where needed, the heat required to sustain the temperatures of the active Tissues. Thus it appears that the purification and proper temperature, as well as the nutrition of the Musculatory Tissue, (the same will be found true of the Nervous Tissue,) are dependent upon the regulated and ever varied flow of blood,

rich especially in oxygen. This again is dependent upon the breath and upon the circulation. Hence, if either the flow of blood stops or if the air is cut off, the purification of the blood and the production of heat cease. Drowning is attended by these results.

Therefore, when breathing ceases, even a child would infer that circulation of blood, and of course all activities of the Tissues should cease, while the greatest attendant evil, the loss of heat, should, by external means, be re-supplied as soon as possible.

Again, the production and circulation of blood, and at least the receipt of air, must go on according to changing circumstances by night as well as by day, when we are asleep as well as when we are awake ; hence all the Musculatory Tissue active exclusively in producing and circulating blood, should be constructed to act, as it does, independently of will and of consciousness, while it must also be subject to centres of harmonizing control by which all its varying actions may be regulated in accordance with the necessities of the case.

TWO MUSCULATORY SYSTEMS.

(Many words have been used very indefinitely in Physiology and Anatomy. Apparatus, Function, and especially this word System, have been very promiscuously used. It is correctly used here, and to mean all of any Tissue of the Body of man or animals, arranged system-atically, or as it exists in any one Body. As there are Six Tissues there are Six Systems having the Six names of the Tissues. The whole Body also, when considered as constructed of Tissues, is properly named the Human System.)

The *Muscular Tissue* of the Body arranged as in the Body is named the Muscular (or Musculatory) System. But it is also subdivided very properly into two Systems, one of which may be controlled by the will, while the other is wholly uncontrollable by the will and is not appreciated by

consciousness. These Systems are named (1) the volitory or voluntary, and (2) the involitory or involuntary.*

Of course this division of the muscles is seen to be unscientific, since it is not dependent at all upon peculiarities or characteristics of the Musculatory Tissue, nor upon any arrangement of the Muscles. The cells are alike throughout, so is their action and their effect. The division is wholly owing to the character of the nervous centres with which the two systems are connected, and by which they are controlled. These are but the appendages, the hands, so to speak, of two nervous systems, and act always in the same way when influenced by any nervous centre.

The muscles which act under the will are not wilful, but act as they do because their musculations are controlled by wilful nervous centres, and their actions must be harmonized with each other and with the outward protection and needs of the Body. The other Muscular System always acts without consciousness, and its musculation must be harmonized with the inward protection and wants of the Body, with the production and circulation and purification of blood, the nutrition and temperatures of the Body, etc. But all this is secured by the distinctive control of the two Systems by the two Nervous Systems. Indeed if two equal portions of Musculatory Tissue from the two Systems should exchange places, the results of their action would be the same as now. Muscular Tissue is merely a contractile and extensile substance, the action of which is excited by nervous tissue. It

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* Sometimes a mixed system is formed, but it is not natural nor of any use. In fact all the Volitory Muscles are used involuntarily more than by the will; there are none which do not at times act without the influence of volition: hence the division in the text is correct. Sometimes the two systems are supposed to be distinguished by one being "striated" the other "non-striated." But these appearances are wholly owing to the structure or make-up of the muscles, and not at all to the nature or modification of the cells, since all the musculatory cells need and have but one nature and one mode of musculation.

properly belongs only to one Muscular System, and works according to the Nervous System with which it is connected, not being responsible for its connections.

The whole matter of the two Muscular Systems will be perfectly understood when we have described the Nervous Tissue.

RIGHT AND LEFT MUSCLES.

When we look at the Passive Tissues in the Body, we observe that in some parts (see Plate 3,) they are constructed into duplicates, but that in other cases,—as in the spinal column, in the skull, etc.,—they appear to be constructed into symmetrical halves of a whole or unit. When we notice the Secretory Tissue we find no indications of a dividing line between the right and left sides ; the skin is one continuous whole, and the hairs often grow precisely upon the middle line, again showing the non-dependence of the Secretory Tissue upon the Nervous Tissue. But as soon as a man takes account of his Muscles and their action, (see Plate 2,) he quickly perceives that he is, at least in respect to them, a pair of twins, of which he is still more persuaded when he studies his Nervous Systems, and perceives that his organs of Sense, his brains and whatever is associated with his volition, are double, completely and perfectly, both in structure, action, and effects, (see Plate 1, also Fig. 16.)

It is remarkable to notice that no portion, not even a cell, from the volitory muscles of one side of the Body extends across over into the domain of the other side. Even in case of the *orbicularis oris*, or circular muscle of the mouth, this is true. It is not a single muscle, (it is not an it but they.) In each lip there are two muscles terminating by one end at the middle line of the lip, in a tendon always very short, but sometimes so long that the skin drawn down to it makes a hair-like or wider crease ; the outer ends of the muscles are at the angles of the mouth.

But if we look at Plate 7 and Plate 1, we shall see that while all other parts of the Body are twins, there is no such twinity between the contents of the Trunk. This is chiefly filled (as is seen by Plate 6,) with unitary organs. There is not only a unitary stomach, liver, gall-bladder, pancreas, small intestine, large intestine, spleen, and heart (one for throwing blood into the Body generally and one for throwing it into the lungs), but the lungs though named plural really are not so. They are not alike in form nor in size, and are in fact and idea two parts of one organ, so are the kidneys. Here then is a great and distinguishing difference. The dual or twin parts are controllable or affected by the will, or volition, are related to Mind, and hence named Mentatory, or concerned in Mentation or mental activity. The Unitary parts are concerned in Blood making, or sanguification, and therefore named sanguificatory ; they are not controllable by the will, and hence are named involitory. The organs (circulatory) concerned in the circulation of blood are partly single and partly double, (see Plate 4) ; that is to say, there are in the Body (or it is constructed of) several Mechanisms, using that word definitely and technically :

(1) Mentatory, double, right and left.
(2) Nutritory,
Sanguificatory, single.
Circulatory, partly single, partly double.

The Muscles of the Double or Twin Mechanisms must therefore be right and left, and located definitely on one side or on the other. The muscles of the Nutritory Mechanism may, like its organs, extend across the middle line. It will be noticed (by Plate 7, and 4, and 5,) that the central organs of the Nutritory Mechanism are merely hung upon the spinal column(s) of the two Mentatory Mechanisms,

and fill the trunk just smoothly full, those above being separated from those below by arching muscles, (the diaphragm,) which properly belongs to the Mentatory Mechanisms is therefore constructed of two independent arches, a point of much value in explaining single pneumonia.

Under the next topic (Nervous Tissue), more will be said upon this interesting subject of the twin mechanisms. Let, however, the reader now reflect, that in the last few paragraphs he has received thought-seeds which, if cast into good ground, are of unequaled importance, not only in relation to our present subject, but in regard to all the affairs of life, as will soon appear in our next topic.

MUSCLES CANNOT BE IRRECOVERABLY DROWNED.

Since musculation occurs when we are asleep, and mostly unconsciously when we are awake ; as it is often suspended for hours, days, and sometimes for weeks, and never occurs unless excited ; since the drowned fly as soon as dry and warm "mounts on airy wings ;" since in fish, reptiles, birds, brutes, and even in man, we see that this Tissue may be frozen and recover ; since many kinds of animals hibernate ; since the hearts taken from frogs, turtles, or from the incubating hen's egg on the third day, beat awhile, stop, yet beat again if put into warm water ; since the Musculatory Tissue, when the air and its essential oxygen are shut off from the blood, merely lies quiet, not throwing out nor taking in any substance, waiting as if to be excited to action ; and as all the muscular cells of all animals have the same nature and modes of action, contraction and expansion, and of course the same muscular or animal motion producible in one way, it appears evident that there is nothing in the Musculatory Tissue that, in case of a person drowning, militates against his restoration, but its nature and modes of action favor the presumption that the

Muscular Tissue, in case of drowning, is waiting to be restored. (The so named *Rigor Mortis*, the stiffness of death, is really the stiffness of life, about which what little is known will be mentioned in the Appendix, when the reader will be better fitted to appreciate it.)

(c.) *NERVOUS TISSUE,*

(*Gangliatory, Nervatory.*)

This Tissue should excite the most intense interest that it is possible for any substance to awaken, on account of what it is, and especially because of what it does, as well as in consideration of the deep mystery under which it as yet veils its modes of working.

Says an eminent writer: "The more complex a substance, the greater is its intrinsic value, and the more specific is its inherent power." This Tissue is, then, the most practically important of all known substances, since it is the most complex, the highest wrought of all.

It is in every aspect and in every relation the King among the Tissues. The Muscular Tissue of the horse may exceed the strength of man, as that of the dog exceeds his fleetness, yet even a clown, by virtue of his superior Nervous Tissue, can put a bit in the mouth of the horse, and bring the dog a suppliant to his feet. Indeed, the independent Secretory Tissue must acknowledge the lordship of the Nervous Tissue, since by regulating the supplies circulated to it, this Tissue rules the activity of that.

Indeed, the Nervous Tissue exerts its mastery beyond the living world, by its means man harnesses the wild winds to his machinery; seizes the stored forces of the sun, bidding them do his will, and even trains the lightning to become his errand boy. Still more wonderful, by the same instrumentality, memory recalls the past, perception recognizes the present, and imagination forecasts the future. The

delightful labors of Praxitiles, Titian, and Beethoven; the genius of Shakespeare; the sublimity of Milton; the science of Newton; the greatness of Cromwell; the piety of Fenelon; the moral grandeur of Howard; the patriotism of Washington, and the fervor of Patrick Henry, were essentially dependent upon their Nervous Tissues. Can then the veriest bumpkin feel indifferent when the instrumentalities concerned in such results as these Tissues aid in producing are presented for discussion?

But, still more wonder-breeding are the thousand *unconscious* activities of the Nervous Tissue,—preserving health, restoring the Body from disease and injuries, at once physician, surgeon, and hygienist; in all cases acting so perfectly, supervising with a prevision so much superior to any skilled intelligence that the very best medical men, from Hippocrates down to date, have always declared that their true function is to "aid nature," which means "aid" the *unconscious* action of the Nervous Tissue. It cannot take the drowned man from the water; it cannot cut down the hanging man, nor dig out the overwhelmed man, nor thaw out the frozen man, nor supply to these nor to other suffocated men the essential heat that they have lost; the *conscious* activity of the Nervous Tissue of another person must be depended upon for all those activities. Hence all should know how to respond to those accidents to which all are exposed, and more especially because then is the very time when ignorance is almost sure to make a gross blunder.

Such compliments to this Tissue may well bring to mind the oft quoted passage of the Psalmist, "I am fearfully and wonderfully made," except that "fearfully" is changed to admirably, by the intelligent student, whose faith in the constitution and in the mode of action of this Tissue is so strongly grounded that he will have no "fear," especially none that this Tissue has not been constituted and con-

structed with reference to its ready recovery, even after being drowned a long time.

Lest, however, the reader should be discouraged, thinking that a subject of such profound significance will be too deep for him to easily comprehend, I hasten to assure him that for present purposes no such recondite study is necessary, and that he will readily understand what will be presented to him, and be exceedingly interested in its perusal. True, he may not find this Tissue quite as simple as he found the others to be ; this topic may require a little closer attention ; yet, perhaps, it may seem even easier, both on account of its unequaled importance, and because his study has familiarized him with the other Tissues, the gate-ways to this.

But, whatever the time and pains necessary, they will be well rewarded by learning what this Tissue can and cannot do, and under what conditions it will do its best and worst. Nothing is of more, nothing is of equal importance ; it is the chief end, and the chief means of enjoyment and usefulness, of man in this world.

Sir Henry Thompson, in a recent paper, with rare felicity, says, "that a man's temper, and consequently many of his actions depend upon whether he habitually digests his food well or ill ; whether the meals that he eats are suitable for the ceaseless work of building up his brain."

This doctrine is now never debated by any authority, neither in the same work of brain building is the essential importance of pure air, and water, and a proper circulation of the blood, denied by any. Yet the prime consideration for which all those things are needed, as the reader will find among the conditions of Nervous Tissue action, is the preservation of a proper temperature. To this its constitution, its location, and all the services of the Body are adapted. The temperatures of other Tissues may vary considerably, without

especial harm, not so is it with the Nervous Centres. They can rise or fall from their natural temperatures (at least in man,) but a very little, without causing great disturbance, delirium on the one hand and on the other torpor. Hence they are constituted more reluctant to take or to lose heat than any other Tissue. They are packed for the preservation of heat, as well as for other protection, in the skull, spinal column, and in the midst of the trunk, neck, and facium. In infancy they are protected by a thick layer of fat, the next best non-conducting substance, and in after years by the hair and by the non-conducting spinal fluid.

The great importance of this matter is still farther shown by the singular adjustment of the activities of the perspiratory tubes of the skin, the drain tubes of the kidneys, and the sense of thirst, all of which have been placed under the influence of the Nervous Centres.

The instant that the temperature rises the perspiration breaks out, especially—and always first—from the head, although that may not be directly exposed to heat, and even may be covered with cold applications, as is often the case in a vapor bath. The "sweat of the brow" is proverbial. The object is to have its evaporation cool the parts beneath. Erasmus Wilson says, that these tubes, so small and short as not to be perceptible by the naked eye, are so numerous—much more so in the head than elsewhere—that twenty-eight miles length of them exist in the skin of an ordinary man. What a drainage? What a capability for cooling the Nervous Centres? No wonder that a man can sweat profusely. Before a glass furnace one lost five pounds in an hour and a half, not drinking anything meantime. The cooling power of such an evaporation is very great. Thirst at the same time becomes persuasive, that water may be drank, while the action of the kidneys nearly ceases, that the supply may not be withdrawn from the skin.

Alcoholic drinks (beer in particular,) tend to check perspiration, hence to produce sun-strokes, so do exhausting labors in hot places, especially if water is not frequently drank.

Very great harm comes from over-heating when not carried so far as to produce sun-stroke. The old proverb, "Keep the head cool and the feet warm" shows where the danger lies.*

But what more concerns us now is that, on the other hand, the instant the temperature falls, the action of the skin is suspended, and that of the kidneys is increased, drawing water from the blood and diminishing its volume, while thirst ceases. The blood now goes its rounds the faster, while the proportion of its burnable materials being greater, heat is produced as well as circulated more rapidly, and the temperatures sustained at least for a time. But this source of heat is gradually exhausted, and the Nervous Centres begin to suffer. Every one has noticed how long he has been in becoming thoroughly warm, even before a hot fire, after he has been "chilled through." Not only do the hands and feet become numbed, but the Nervous Centres are so impaired that perhaps speech or other functions are impossible, as the writer has experienced.

How long, then, may be needed for the restoration of a person chilled to coldness by drowning, or by other modes of suffocation, especially if he is fat? Hours may be required to "warm him through." If any one recalls how much a cup of hot drink warms him he will realize the value of injecting into the bowels or the stomach of a drowned, (or otherwise suffocated,) or of a very much chilled person, a quantity of nearly scalding hot water.

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* Cats and dogs which have no perspiratory tubes (evaporation from the dog's mouth serves a partial purpose,) for cooling their heads, hot by exposure to the sun or to fire, often have "fits," which are cured by pouring cold water upon their heads. Horses, which sweat freely, bear hot weather well.

Drowning has often been induced by a small loss of heat when a person had but little to spare. Remember that cold water takes heat from the Body very rapidly : it may have been reduced by drinking cold water, by exhausting labor, by having been in the water a short time before, or the person may naturally have a small supply. The loss of a little heat may then impair the Nervous Centres so much that they can not induce nor supervise the musculations necessary to prevent drowning. How often do we see it stated of a person who went into cold water that he had a cramp. A person likely to be easily chilled should not venture into water of a drowning depth, and surely should not remain in it until chilled. The slightest chill anywhere is a thing always to be regarded as a military command. Obedience to it will save many a life and much ill health. It is not then dangerous to take a cold bath because a person is warm, indeed that is always a favorable condition ; if the heat is produced by exhaustive labor, the heat is still very favorable ; it is the exhaustion which requires a short stay in, or avoidance of, a cold bath. Do not then, if warm, wait exposed to the air to become *cool*, (you may to become restful,) before bathing. The Russians go with impunity from the vapor bath to lose their heat in a cold water bath, and find it delightful.

The slight continuous depression of the temperatures of the Nervous Centres is very mischievous. Hearty boys have "gone in swimming" so often and staid in so long that they never recovered their vigor, and others have developed latent diseases that might never have shown themselves. Long exposures to cold air are in like manner unfavorable. Infants, the aged, the debilitated by disease, and the poor often suffer from being scantily clad, fed, housed or warmed. One person cannot be a rule unto another. He who has heat to spare should lose it by thin clothing, cold baths, or any other exposure that he prefers ; but he who has not, should

clothe warmly, and take warm baths. The writer once, for three weeks, persevered in the daily use of a cold shower bath, by which time he felt sleepy all the while. Fortunately a few vapor baths on successive days restored him.

Over-heating one part of the Nervous Centres, and keeping another part too cool, as women so frequently do, when they clothe thinly, or not at all, the upper part of the spinal column, and burden the lower part, is productive of precisely that broken down health and suffering which we so commonly see. Don't do it.

The marvellous rapidity, precision and harmony of action of the skin, of the sense of thirst and of the kidneys, parts distant from each other, yet working more as a unit than they could if really a unit, show us plainly that the preservation of the proper temperatures of the Nervous Centres is of prime importance.*

This shows the wisdom of the old proverb, "Cool a part that is too warm, warm a part that is too cool." It also teaches that in case of suffocation from drowning, or otherwise, the conditions essential to the welfare of the Nervous Centres demand that further loss of heat be, if possible, prevented, while that which has been lost must be, as speedily as possible, restored.

We will now find farther illustrations of these ideas in the structure of those Centres.

TWO NERVOUS TISSUES.

It has been already seen that the action of the Muscles

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* The rapidity with which those activities increase, decrease, and interchange, is practically perceived when we ride long in the cold and then come into a warm room, and partake of warm food and drink. The annoying action of the kidneys instantly ceases, the skin becomes moist, and the thirst compulsory; if gratified the annoyance of the kidneys again occurs as soon as we are again exposed; if foreseeing this we resist the inclination to drink our after ride will be undisturbed.

demands many Nervous Centres, and also appropriate connections between the centres and their related muscles. (These centres are named *Ganglia*, and their action *Gangliation;* the connections are named *Nerves*, and their action *Nervation.* *)

It will also be perceived upon reflection that everything that the centres, or ganglia, can do in or through the Body, must be done by means of motion, which is effected by musculation ; and it follows that—except with the muscles—the centres need no outward connection through which to exert their influence. The connections that perform this office are named the Motor or Motory Nerves, and are the only ones which in the Body lead out, or exert any influence, from the Centres. This again proves that all that they do in or through the Body is done by Motion, a fact of great moment and interest, and worthy of the most considerate thought of the student. It is also a notable fact of great importance that no out-bearing nerve terminates anywhere else in the Body, except in Muscular Tissue, which demonstrates that the Nervous Centres do not exert any influence upon any other Tissues directly, and never indirectly, except through the Muscular Tissue.

But if a Centre is responsible for the proper control of a Muscle, its condition must in all reason be constantly made known to the Centre. This requires an inward acting connection between the Centres and their related Muscles ; that is, a double set of nerves are needed between the Centres and their Muscles.

(By the way, how the nerves act or what they conduct, no one as yet knows. That which acts through them is

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* These are the general names used herein for the general action of Ganglia and of Nerves. It is a matter of great surprise that no general name has been long ago applied where one is so necessary and so useful in aiding the physiologist to develop his thoughts upon this subject.

FIG. 12

Fig. 12 is an ideal plan of the brains, cord and their nerves, as they would appear looking through the Body, supposing it to be transparent, and no other parts to be seen. It represents the Volitory Cranio-Spinal Nervous System.

named Nervous influence, which is indefinite enough not to be wrong ; that which acts from the Centres is named *Motory* because it induces *Motion*, and that which acts inwardly or upon or into the centres, is usually named *Sensatory*, because it sometimes, or even often, induces *Sensation*. Yet the fact is that in a large majority of cases the inward acting influence produces its proper effects without inducing either sensation or consciousness. Hence the name Sensatory influence in this connection is usually a misnomer. This influence inward without causing sensation, but inducing influence outward causing motion, is named *excito-motory*.)

Again, the Centres must often control the Muscles with regard to the world outside our bodies : hence, must be informed about, or influenced by it, must look upon, listen to, smell, taste and touch, as well as handle it, by means of the right and left eyes, ears, noses, mouths and skins,* and of Sensatory Nerves connecting these organs and the Centres.

If now there is such an anatomical arrangement in the Body as has been forecast as necessary, it will readily appear. In fact it does exist in the Body, crudely shown by Figs. 12 and 13, and more in detail, though not as clearly, in Plate 1. In Fig. 13 we see a representation of the great centres of voluntary life, corresponding to the voluntary Muscular System, forming the brains of the head, and also the most essential brains or centres or ganglia of the spinal cord. From these centres, Nerves (twins) right and left, extend into the Muscles, and from all parts of the Body into the Centres. (See also Fig. 18, in which the same centres and nerves are shown with their sheath removed, and Fig. 14, the same in their sheath.)

That these centres and nerves belong to one grand Sys-

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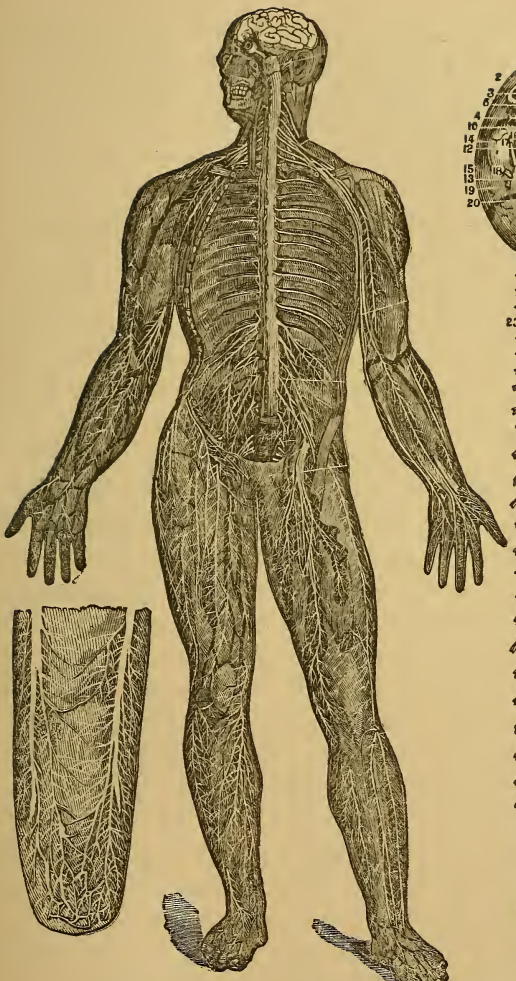
* The plural is used here because the sense of taste is double in the mouth, and the sense of touch double in the skin.



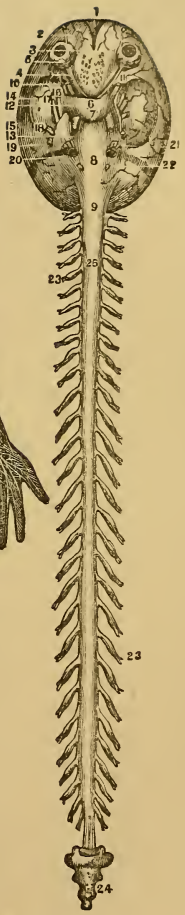


Fig. 15. Fig. 13. Fig. 14.

Fig. 13 represents the front, side, and under view of left brain, the front view of spinal cords, and of the volitory nerves.

Fig. 14, front view of sheath enclosing brains, spinal cords, and roots of spinal nerves.

Fig. 15, end of finger, natural size, with its nerves very much enlarged.

tem is plain, since it is shown by Fig. 14, (the nerves are cut near the cord,) that all these centres and nerves are enclosed in one common sheath, constructed of Sinewy Tissue, and having many branches, like the bark of a tree. This enclosure and its contents are entirely independent of other parts, except that it is pierced by blood tubes, carrying blood to and from its contents ; it is also here and there attached to surrounding parts by fibres of Sinewy Tissue.

It has been mentioned that the Centres are placed in their bony cavities to maintain equable temperatures, and the non-conducting fluid about the cord was said to have the same office. The peculiar structure and elasticity of the spinal column and cranium also protects the Centres from the effects of jars or rude blows ; the spinal and cranial fluid does the same thing most curiously and ingeniously. The Centres (see Fig. 14,) do not fill the cavities in which they are located. These are lined by a dense membrane of Sinewy Tissue, named *Dura Mater*, which is itself lined with serous Secretory Tissue ; the sheath around the centres is also covered with the same. Both surfaces freely pour out or secrete the delicate glairy serous liquid named serum, and the ensheathed centres therefore hang, rest, or when we lie down almost float, in the midst of this perfectly protective liquid packing in a way that must excite the highest admiration of every observer.

In early years the elasticity of the skeleton makes very little fluid necessary, and there is very little space for it, the lubricated surfaces in the skull and spinal column touching each other without friction ; as age progresses the space becomes larger, especially beneath the brain where, by intersecting Sinewy Tissue, it becomes divided into small connecting spaces, making a veritable and perfect hydrostatic bed on which the brains rest, (see Fig. 16,) serving two purposes : (1) to prevent jar from reaching the delicate cranial

centres; (2) to hold the brain firmly but gently in its place, (see description of Fig. 16.)

Fig. 16.

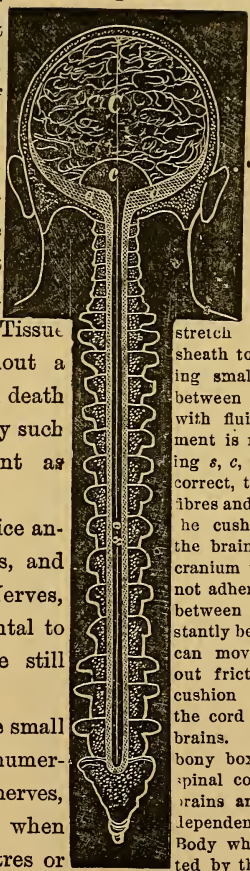


Fig. 16 is a sketch or ideal plan of a perpendicular section of the head and spinal column, and of their contents; *C*, *c*, brains resting on the hydrostatic cushion, *a*, *a*, which is constructed of the delicate sheath covering the brains and spinal cord on the inside, and of the thicker dense sheath lining the cranium and spinal column on the outside, as seen in the cut. Sinewy fibres stretch across from the inside sheath to the outside lining, leaving small communicating spaces between them which are filled with fluid. This same arrangement is represented as surrounding *s*, *c*, spinal cord. This is incorrect, the space is clear of cross fibres and filled with fluid. Above the cushion, the sheath covering the brains and the lining of the cranium touch each other, but do not adhere, nor do any fibres pass between them; but they are constantly bedewed, so that the brains can move within their box without friction. The fluid of the cushion connects with that of the cord and that of the upper brains. It is seen that if the bony boxes, the cranium and the spinal column, were removed, the brains and cords would stand independent, as they are in the Body when surrounded and isolated by their surrounding fluid.

Is it possible for any one to contemplate these exquisite provisions against liabilities, and still suppose that this Tissue has been left without a hope of escape from death when jeopardized by such a probable accident as suffocation?

But we must notice another set of Centres, and their connecting Nerves, still more fundamental to life and if possible still more interesting.

These centres are small (see Fig. 17,) but numerous, connected by nerves, (here, as elsewhere when connecting the centres or

The fluid will always move more quickly than the less fluid-jelly-like brain, and in case of the rapid motion of the head, will be impelled into that part of the cushion which will hold the brain snugly, and prevent its being thrown against the sides of its enclosing box. Also, when the back is curved, the capacity of the spinal canal being lessened, a portion of its fluid will be crowded up into the cushion, holding the brains snugly. In some persons the brains are not only pressed but compressed by stooping, causing them to feel dizzy.

I esteem this arrangement the most ingenious, the most admirable, to be found in the human body, or in any animal, or even celestial mechanics.

FIG. 17

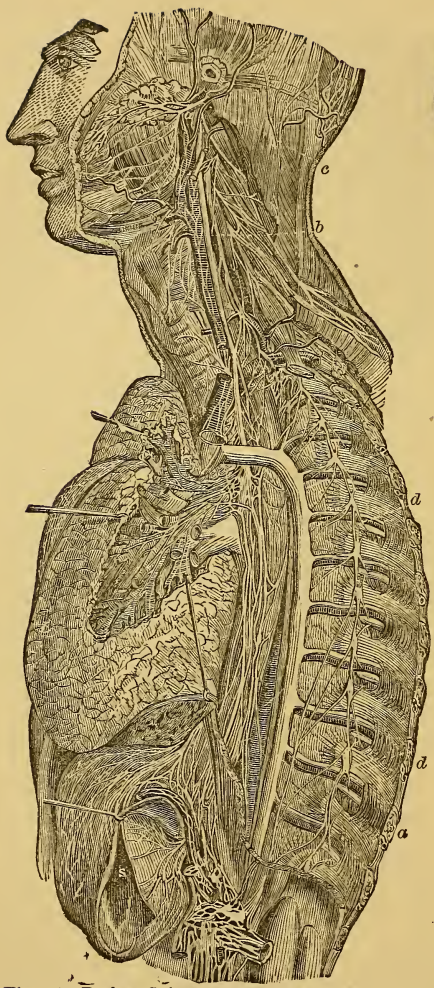


FIG. 18

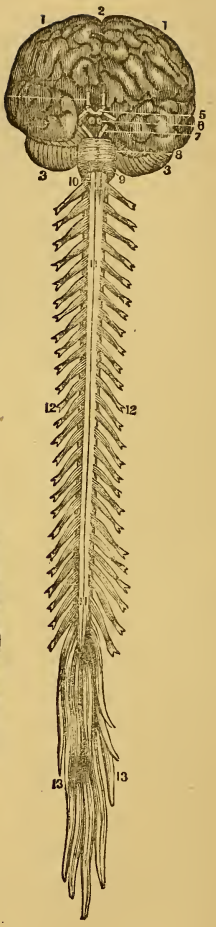


Fig. 18. Brains, Spinal-cords, Nerve-roots.

Fig. 17 is (in the original,) the most exquisite illustration ever made of any part of the Body. L. the left lung, and S, the stomach, drawn forward toward the right side, and a portion of them cut off, as is a portion of the liver between them, in order to show clearly the parts back of and in them, especially the nerves. *d*, *d*, the left chain of circulatory, (organic, or sympathetic,) ganglia, commissures, and nerves ; the location of the ganglia or centres should be

(*See bottom next page.*)

parts of the same centre, named commissures,) thus forming a long chain upon each side of the front part, or body, of the spinal column, the whole length of the back part of the trunk; three larger ones are located in the midst of each neck, (right and left,) while four still smaller ones are located in the midst of each facium; plexuses belonging to both chains are also found in trunk, (see Fig. 17.)

The nerves from these centres follow along upon all the arteries, (Fig. 19, also Plates 4 and 6,) and as these lead into every part of the Body, every part is thus subject to these ganglia, and the circulation of blood in every part is thus regulated. These centres the last to cease are the first to commence their work, and therefore the first to be considered, cared for, and worked upon, through, and with, in case of suffocation. I will recur to this subject farther on.

It certainly is now apparent that the appearance, location, use and constitution of the centres and of the nerves are so different that there must be two Tissues, not merely one, nor two varieties of one. These should also be distinguished by two names as herein proposed.

NERVA-*tory* TISSUE, (CONCERNED IN NERVA-*tion*,)

Is to the naked eye a white pulpy substance, in the form of cords, varying in size from that of a finger to that of a spider's thread, or of the smallest object visible. Seen under a microscope the smallest of these is a bundle of fibres thousands in number, that continue to branch until extending beyond their sheaths, which have become more and more delicate, each fibre terminates singly at its proper place; the Motory fibres at the muscle cells, and the Sensatory fibres in the Body generally except the Secretory Tissue. The inner ends of both kinds of nerves are connected with the cells of the centres as by and by shown. Hence all points of the Body in which the outer ends of the nerves

Fig. 19 illustrates one class of blood-tubes, called arteries, commencing at H, the heart, and dividing and subdividing, according to the members, until all parts of the body are reached, where they terminate in the next class. The capillaries are a network of hair-like tubes, too small to be seen by the naked eye, into which the arteries pour their contents. They are more numerous in the brain than in any other part. From the capillaries the veins commence (see Pl. 5), and uniting together, and also receiving the contents of the fourth class of tubes, they at last open into another part of the heart, from whence the arteries lead out. The fourth class of tubes, called lymphatics (see Pl. 5*), commences in every part *except the brain and nerves*, and open into the veins, and thus their contents find their way to the heart. BA, brachial ; FA, femoral artery, at the point for compression, in case of injury.

FIG. 19.

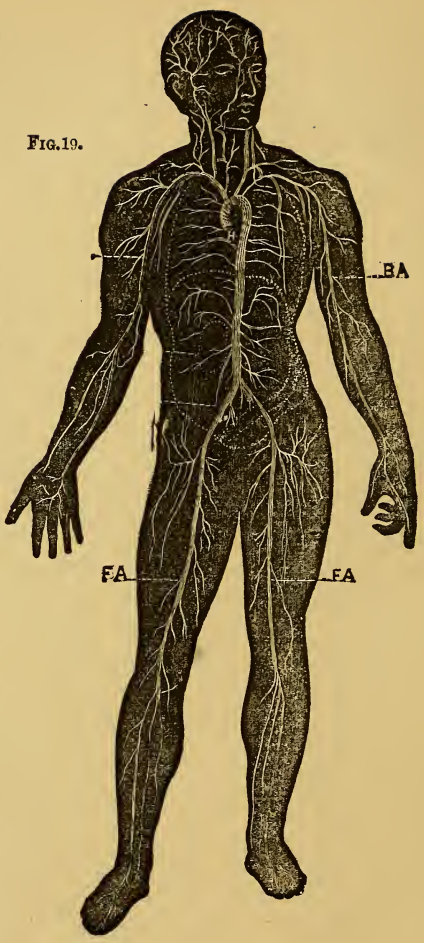


Fig. 19.

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followed up through the neck. *b* is the great pneumo-cardio gastric (lung-heart-stomach,) nerve ; (trace down to its connections). Back and to the right of the stomach, as it is shown here, is a part of the great nervous plexus, which makes it so dangerous to strike a person over the stomach, especially when it is full. Nervous substance can bear almost anything better than it can a blow or concussion. If it happens in drowning the case is usually hopeless.

begin or end are represented in the centres, a fact worthy of contemplation, (see Fig. 20.)

All the nerves appear to be alike in all respects except location and connections, and they doubtless act alike, and

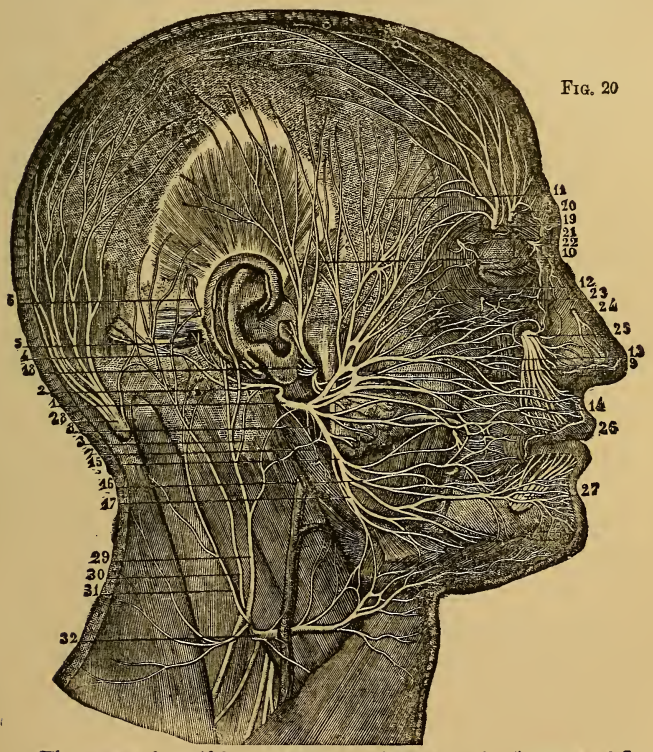

FIG. 20

Fig. 20 is a beautiful representation of the superficial nerves of the right Head and Neck, which will be particularly interesting to those troubled with neuralgia of the face, since they can appreciate the fact that if a main branch of the nerves is affected, the pain may seem to be at many points, though most of the nerves shown are motory; 1, being the *Facial*, through which the muscles of the face are controlled by the will, and the avenue through which they are acted upon by the emotions and expressions caused. The bunch of nerves, 25, *Infra-orbital*, and 27, *Inferior-dental*, extending to the upper and lower lips, are especially noticeable.

could change places with each other. They are apparently quite passive, like telegraph wires, are mere conductors, undergo changes slowly, need but little blood, and have few blood tubes, hence their whiteness. Their outer extremities are often exposed to severe cold, are sometimes quite frozen yet easily recover. There can be no objection, therefore, to our believing that this Nervatory Tissue will be readily restored in case of drowning.

GANGLIAT-*ory* TISSUE, (CONCERNED IN GANGLIAT-*ion*.)

This Tissue should command the attention of every one. True, for thousands of years the world has had its well-applauded heroes, its intellectual giants, and its profound scholars, who accomplished what they did without even knowing that they had such a Tissue. Yet while this proves that the scientific knowledge now accessible on this point was not essential to their development, nor to their activities, it is probable that every one who reads only what follows, and still more so that one who studies the subject, will be convinced that even the greatest men the world has ever had, might have profited mightily by the use of this knowledge. *

UNDER THE NAKED EYE.

This Tissue appears to be a reddish grey pulp, forming the outside of the large Cranial centres or Ganglia (see Fig. 21), the middle of the spinal Ganglia (see Fig. 22), while it is intermixed with the white fibrous Nervous Tissue in the other centres. A larger proportionate number of blood tubes in the form of a fine net-work surrounds and is inter-

* The other Tissues equally demand pure air and pure water, but this Tissue demands a food more complex and intelligently cooked than those do. Instinct and appetite when natural are nearly scientific in their selections, as history shows in case of the ancient great men, but the perfection of the Nervous Tissue demand the selection and preparation of its food under the supervision of perfect Tissue.

FIG 21

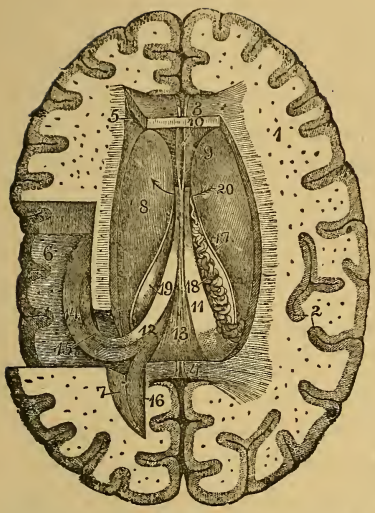

Fig. 21 represents the brain sliced a little lower than in the preceding figure. 1, the white tissue; 2, the gray; 3, 4, the front and back portions of the bridge or corpus callosum, the middle portion being removed and exposing the ventricles, in which, and forming the sides and floor of which, ganglia are seen. Portions of the brain are cut out to show 7 and 6, extensions of the ventricles; 8 is one of the largest ganglia, and from the white and gray substance being in alternate layers, it appears striped, hence its name, striated body (corpus striatum); 19, portion of thalamus; 14, hippocampus; 18, a plexus of capillary vessels (the choroid plexus).

NERVES RELATED TO MUSCLES

{ Motory.
{ Sensatory.

FIG. 22

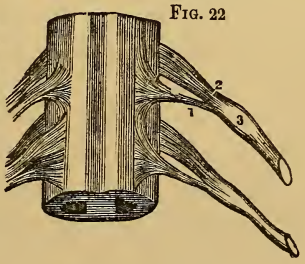

Fig. 22 represents a section of the spinal cord, with 1, 2, the roots, as they are called, of nerves extending from it on each side. 1 is motory, 2 is sensatory; beyond 3 they are enclosed in one sheath, and no longer distinguishable. All the spinal nerves are similar. Where they arise from the spinal cord, they are seen to be numerous; they are equally so in their sheath.

woven through this Tissue than is found elsewhere. A gauzy lace work of Sinewy Tissue is also interwoven through this tremulous Tissue to sustain it in its place and form, while a continuation of the same fibres, condensed into a thin membrane, ensheaths the grey Tissue, its associated white fibres, and its blood-tubes, completing a centre or Ganglion. Several may have but one sheath, (see Fig. 14.)

The extraordinary amount of blood supplied to this Tissue proves that its activity is exactly the reverse of that of the white Nervous Tissue. Hence it is comparable to the telegraphic battery.

The blood which flows to it is of a bright red color, that which flows away is dark red. It has undergone a change, the Tissue must also have changed. It has taken from the blood choice materials, and has thrown into it its effete substances, produced by its activity, which is dependent upon this change.

These effete substances, harmless, even promoting health when in small quantities, would become poisonous by accumulation, did not that faithful scavenger oxygen seize upon them as fast as they appear in the blood of which it is a part, and burn or oxydize them into harmless compounds for the kidneys to eliminate from the blood. What they remove from the blood is therefore sure evidence of the activity of the Grey Tissue. By this burning the oyxgen of course raises the temperature of the blood and of the Tissues in the neighborhood. If that is too low an important service is rendered, if it is too high the perspiration must break out, that its evaporation may carry away the surplus heat from the Grey Tissue. *

It must be remembered that oxygen can serve its purpose but once. When it combines with the effete substances it is no longer active oxygen, this must therefore be constantly received by the blood from the air which is breathed, especially for this purpose. It will also be recollected that

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* Those who in hot weather wish to use their Nervous Centres actively should remember the old proverb "keep the head cool," should avoid alcoholics, apply cold baths over the centres, ice the air of their rooms, and have the backs of their vests cut open, since the spinal column should be kept cool as well as the head. Do not let the feet get cold in summer more than in winter.

the blood goes its entire rounds in from three to five minutes, and is therefore soon exhausted of its oxygen.

It is logical, therefore, to infer that when oxygen is no longer received from the air, the action of the gangliatory Tissue will soon stop, since the want of oxygen in the blood will lower the temperature of this Tissue upon which its action is dependent.

Drowning, then, or suffocation otherwise, by shutting off the supply of air and its oxygen, lowers the temperature of the Nervous Centres, as also does the cold water applied to the skin, and stops their action, preventing the poisoning of the blood and quieting the motion of all parts of the Body, thus preventing further loss of heat.

Does not this prove abundantly that immediate death by the frequent and necessary contingency of drowning, and by suffocation otherwise, has been provided against by Nature ?

UNDER THE MICROSCOPE.

This Tissue, to the naked eye a mere pulp, is seen to be beautifully organized, and that, as in case of the other two active Tissues, its efficient means of action are Cells. (See Fig. 23).

Fig. 23.

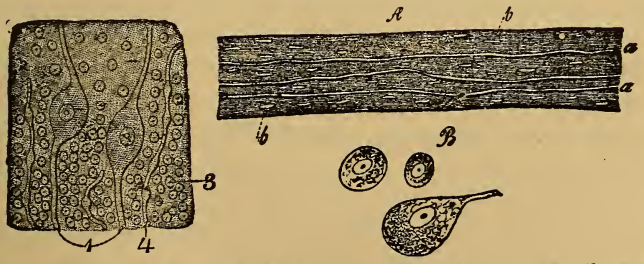

Fig. 23 represents nervous tissue: 1, two large cells continuous with nerve filaments; 3, undeveloped cells with nuclei; 2 and 4, a chain of cells connected by filament; B, nerve-cells much enlarged, showing nucleus, its spot, the granules, and one extending point or pole in case of the largest cell; *a a*, filaments of white nervous tissue.

The granular substance surrounding the cells is a characteristic worthy of notice, distinguishing this from the other Active Tissues. If a portion of this be removed it is not replaced by Nervous but by Sinewy Tissue, which cannot of course perform the duties of the grey Nervous Tissue.

The writer in boyhood knew a boy who was struck by the foot of a horse, consequently he lost half a tea-cupful of brain from his left forehead. The cavity was refilled by one form of Sinewy Tissue. Yet, as boy or man, (he is still living,) the person never experienced any inconvenience, and was as before remarkably bright. He still had his right brain complete.

These cells, like the muscle cells, act by taking substances from the blood, causing them to undergo certain changes, and then casting them back again into the blood, and in this case as in that, the substances thrown back into the blood are effete, and must in part at least be oxidized, or burned by oxygen, and by the kidneys be eliminated from the blood.

SCATTERED MOTOR NERVOUS CELLS.

Motor Cells are sometimes scattered; one is found by the side of each scattered Muscle Cell to excite it to action. These two cells may be considered as a typical animal. But, more important to our purpose, these motor nervous cells are scattered through rhythmical, constantly acting muscles, like the heart, etc., which are also connected with regulatory cells in harmonizing centres. Such muscles may be regarded as an independent animal. The heart of a turtle beats when out of the body, and when chilled stops, but when warmed, beats again, and when at last exhausted beyond the power of heat to excite, it will still beat if pricked or excited by an electric shock; a fact which may be of great importance in connection with drowning, if for any reason, when well warmed, the heart refuses to beat.

Usually the Motor, and always the other Nervous Cells, are gathered in immense numbers in Centres or Ganglia; the smallest, not larger than a pin's head, being furnished with thousands of them, each one being a store-house of molecules ready to bestow their astonishing properties and capabilities for the welfare of the Body.

It is plain that these cells must be maintained at a proper temperature, and supplied with blood rich in the proper materials.

Some of them, the motor cells, appear to need an outside stimulus, as it is named, an exciting cause of action, remaining quiet unless thus excited; the sensatory and emotory cells also seem to need their outside stimuli, although drugs in the blood will suffice, precisely how we do not know; but we do know that laughing-gas inhaled will stimulate laughter, and that opium, etc., will produce their singular effects, despite the will. Alcohol may arouse the most deadly passions, jeoparding the lives of others; hence, why its use should be prohibited by those others.

Some of the cells appear to be constantly active without any other stimulus than that of the blood. Every one in his waking moments is constantly thinking; this he does by, or by the aid of, Nervous Tissue Cells.

If we feel the pulse to be slow we may forecast that the person will ganglianize deliberately, that is, his cell action or thinking will be slow, he will be slow to anger, etc.; speech must be addressed to him slowly, or it will be of no use. But if his pulse is very quick he will catch the "winged words," and interpret their meaning at once, but will be apt to speak too fast for persons having a slow pulse to understand him. A very important thought for instructors to regard in addressing the public, or in teaching individuals, old or young.

The person with slow pulse will remain under water or

hold his breath longer without inconvenience, will be longer in drowning and in recovery, but will recover after a longer time, he will have, while drowning, a greater memory of the facts of his life, and will dream more than the man with a quicker pulse, who needs and uses more air or oxygen in a given time ; has smaller air cells in his lungs, and more of them, thus exhausting the air of its oxygen quicker, is therefore quicker to perceive an idea, acts less deliberately, thinks more in a given time, gives less time to the preparatory unconscious gangliations, is quicker tempered, not so enduring, enjoys life more hilariously, but suffers more from mental depression, etc., etc.

Memories occur when a person is drowning, not when he is drowned—he is also "drowned in unconsciousness." The restored will often say that he remembers every act of his life, but when cross-questioned will allow that he did not remember one act in ten that occurred. Such memories, like dreams, will occur when the activity of the nervous cells is reduced to a certain degree. Hence, when any person is drowning, the oxygen being shut off from the blood as was previously stated, the nervous cells related to memory, at the summit of the system, become depressed in activity, and, for an instant only, pass that point at which a thousand occurrences flash upon the memory. To remember a thousand events at once is as easy as it is to remember one, there is no effort in either case. As many of these occurred at long intervals, it will seem to the person that as much time elapsed in the remembering as there did in the occurring. I. will also be apparent upon reflection, that we cannot recall the original occurrence that we usually say that we remember ; we can recollect only the effect of it, and usually recall only our memory of a previous memory of that effect. Often a series of memories so much distort the first one that what most persons remember about long past oc-

currences often recalled is not worth repeating, since each memory has changed its antecedent.

It is also noticeable that when a person eats a full meal, requiring much blood in the stomach, not having enough to maintain also the activity of the brain cells, the person feels sleepy, and if he sleeps is apt to dream, because the blood is not so much withdrawn from the cells as to prevent their dreamy action. Also, when a person inhales gas at the dentist's, it depresses the activity of the cells, and he dreams.

(It is a very curious fact that these reminiscences of occurrences are never attended by chagrin, nor shame, nor pain, however unpleasant or painful the occurrences were, or the memory of them, under the ordinary circumstances of life, would be.*)

It is also a fact of marked importance that the cells of only a few of the ganglia take on the degree of activity that pertains to consciousness. A few ganglia only are furnished with a number of blood-tubes sufficient to supply the blood essential to conscious cell activity. Some ganglia, under extraordinary circulation of blood, will exhibit consciousness, but most of them can never experience that high degree of activity.

NERVOUS SYSTEMS.

An in- and an out-bearing nerve, with a cell between them, constitute an ideal or typical Nervous System. Practically many of these, concerned in a common act, are grouped and named: those concerned in respiration are named Respiratory Nervous System. Every muscle must belong to some system or to several. The Respiratory Muscles are

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*I must note that, on the other hand, some think that the cause of a vivid memory is over excitement of the cells, which view has its arguments. But all allow that the memory in case of the drowning is but a flash, induced by a peculiar activity of the cells.

also used in speech, and belong, therefore, to at least two systems.

One of the most beautiful instances of the working of a Nervous System is noticeable in the experiments upon the eye with light ; review it.

HUMAN NERVOUS SYSTEM.

This includes all the Nervous Tissue in the Body, naturally or systematically arranged. It is exactly double, or constituted of twins, right and left, precisely as we have two eyes, two hands, etc. Each is the counterpart of the other in the kind of act it performs, and if they are equal in vigor they will be counterparts in the amount of their work. Usually one is naturally weaker, or is made so by neglect to use it. It should, if possible, be developed to par, that their work may be interchanged, and each allowed to rest. If a person writes alternately with each hand, he can do more and do it easier, without risk of "writers' cramp." Alternately using the Nervous Centres, a person will accomplish much more intellectual labor than is usual in a lifetime, without risk of the results of overwork, and with only a little more expense for nervous food.

The eyes and their centres should be rested by alternately closing their lids for a time, or one should be trained to long and the other to short sight. A weak person, as all know, is more sensitive to a nervous shock. A weak twin is so far such a person, hence it is often quite difficult, or entirely impossible, to restore a person who has a very weak twin, and that side must receive especial attention : heating, rubbing, etc. It will be evident from its smaller size.

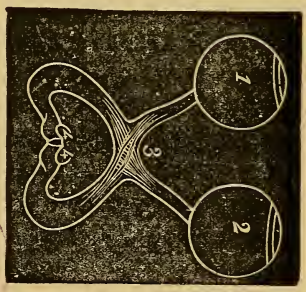
It is remarkable that a large number of the motor nerves coming down from the cranial motor ganglia, and forming part of the spinal cords in the neck, there cross from the right cord to the left, and from the left to the right, and

then extend to the muscles of the respective sides ; the muscles of the left side being in part at least connected with the right cranial centres, and in part controlled by them. *Vice versa*, the right muscles are at times controlled by the left ganglia. None of the in-bearing nerves cross, except those from the left half of the right eye, and those from the right half of the left eye. (Fig. 24.) The former cross (decussate) to the left, and the latter to the right ganglion ; thus each eye is connected with each (right and left) sensatory ganglion of sight. When any threatening

Fig. 24. 1, 2, eyes, from which nerves extend to 3, where the fibres from the left half of the right eye cross to the left ganglion 4, and the fibres from the right half of the left eye cross to 4' the left ganglion of sight. The fibres from the right hal of the right eye and from the left half of the left eye extend respectively to the ganglion of their own side.

"Does the image of the murderer remain upon the retina of the eye of a person murdered by suffocation ?" "Can the position of the drowned be seen by the clairvoyant ?" are questions by educated (in the usual sense of the word,) persons, answered in the description of Plate 8.

Fig. 24.



object is coming toward the Body from the right field of view, the light from it entering the pupil of either eye, will reach the nerves in the left side of it, (see Plate 8 and description,) through these nerves the left ganglion will be affected, and directly or indirectly it will cause an influence to be discharged through the motor nerves, which, as was said, cross in the neck to the muscles of the right side, which will ward off the danger ; all being done quicker than one word of this description is written or read. This arrangement is of especial necessity in case of blindness of one eye.

These crossings do not in the least disturb the idea of the twinity of the Nervous Systems. Dr. B. W. Richardson, the highest authority in the world, says, "No fact is more

striking than the complete isolation, the perfect distinctness of the Nervous Centres."

In view of this very curious precautionary arrangement against a double accident, can any one suppose that liability to suffocation has not been prevised ?

VOLITORY AND INVOLITORY NERVOUS SYSTEMS.

It must be quite evident that there are two grand domains in the Body, under the sway of two distinct sets of Nervous Centres. One of these with its Nerves is named the Volitory and also the Cranio-Spinal Nervous System. The last name signifies that it is divisible into two systems. The Spinal System has two long ganglia occupying the central portions of the whole length of the spinal cords (right and left, dark spots, Fig. 22). All the spinal nerves proper terminate in, and commence from, these long ganglia, but many of the fibres, spinal by name, form the outer portion of the spinal cords, and extend up to the Cranial Ganglia. Within the spinal canal, but outside the cord, (see Fig. 22,) and upon what is named the back or sensatory root of each spinal nerve, there is a small ganglion, the use of which no one has ever guessed, nor is there any knowledge as yet about its gangliations, nor any ground for inference except that being only upon all Sensatory Nerves they must have something to do with sensations.

The Spinal System is entirely motory, involitory, and never associated with consciousness. It regulates some of the movements of the extremities, and a part of those of the muscles of the walls of the trunk.

Just above where the Spinal Cords enter the Crania they show a pear-shaped enlargement of great interest on account of its importance in relation to the blood-making organs. It may be considered as the summit of the cords, as the lower part of the brains, or, better, as a part of a contin-

uous whole ; two group of twin centres, they, through connecting nerves, control respiration, influence the musculations of the stomach, intestines, and even of the heart, organs concerned in producing and distributing blood. Hence, why the measures of the base of the head, heretofore mentioned, have their great importance, and are so reliable as data of the potential longevities of men.

These centres at the base of the cranium are closely related to those above them. The respiratory centres are controlled by those of speech, but cannot be controlled by any centres long enough to suspend animation ; since as soon as oxygen is shut off by the stopping of the breath, the cells of those ganglia which are controlling the respiratory centers, begin to be depressed in activity, and quickly lose their power over the respiratory centres below them, which, at the instant of relief, start into action, and work the breathing apparatus with a saving effect. These centres, of course, are double, the whole breathing apparatus is. When single pneumonia (of one lung,) occurs, the corresponding apparatus ceases to act, that the diseased lung may the sooner recover. The other apparatus does all the breathing. If double pneumonia occurs both lungs cannot be entirely quiet, one or both must breathe a little. To reduce this necessity to the lowest point is evidently essential to the welfare of the patient. Observe how admirably the self-acting unconscious gangliation consummates the desired work. The shutting off of the oxygen depresses the activity of the nervous cells every-where, producing stupor, deafness, closed eye-lids, a posture on the back, a very low pulse,* etc., etc.

How more than wisely Nature acts through the medium of unconscious gangliation ; how more than unwisely man

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* 10 pulsations per minute have been noticed, followed by perfect recovery. Three doctors had given up the patient as sure to die, and forbore to do anything, which was precisely what was needed.

often acts through conscious gangliation, administering alcoholics, (the worst of poisons in these cases,) etc., endeavoring to arouse the patient that Nature is trying to keep quiet. As soon as it is proper for the lungs to receive air the breathing becomes vigorous. Does not our reason infer that Nature will be as kind to those accidently suffocated? This provision against death by sickness certainly suggests that equally good provisions have probably been made against death by drowning.

These centres are often named vital. Some think that if their activity ceases, at least if they become cold, breathing and heart action cannot again be induced. Cases cited forbid this doubt. However, the very great importance of these Centres must not be overlooked. Their large nerves (Fig. 17,) extend down to the Trunk muscles engaged in blood making, also to the heart, the action of which must also be regulated by those centres. Cases have occurred in which its action could be stopped by volition, while, as all know, it is especially disturbed by the excited emotions. Pain is also produced through sensatory fibres of the same nerves; for example, when the muscles of the bowels must contract to a painful degree in order to propel their watery contents; or when certain canals (perhaps their muscles,) are painfully distended. Such facts show that some of the fibres of these nerves extend above the usually unconscious vital Centres up to the usually conscious Centres.

The location of these vital Centres in the middle of the base of the head, suggests that they will become cold, and *can be heated very slowly.* This must not be forgotten.

THE UPPER CRANIAL GANGLIA

are Sensatory, Emotory, Intellectory, and Motory, (Volitory,) as we know from the functions performed by them. The Sensatory and Motory nerves entering the crania ap-

parently connect only with the Sensatory or the Motory ganglia. But as the Emotory and Intellectory are also acted upon by, and exert an influence upon, the Body, they must also receive and send out influences, indirectly through the other ganglia named, which is probable, or directly through a part of the Sensatory and Motory nerves, which part in that case must extend up into these ganglia.

The activities or gangliations of the Mentatory ganglia exhibit a very remarkable and profoundly important distinction. Most of them, like those of all the other ganglia, are not attended by consciousness, but some of them are.

How the same cell can be active, now with and now without consciousness, is marvelous. No one as yet knows nor has any one suggested how to account for these surprising results. The only explanation seems to be that consciousness requires a very intense activity, whereas a lower degree is consonant with unconscious gangliations. Only the cranial ganglia rise to the activity required to exhibit consciousness, at least seldom if ever do any of the other ganglia exhibit consciousness. Many facts sustain, none are adverse to this view. The weight of a finger upon the exposed consciously active ganglia will instantly suspend consciousness while the pressure continues ; the moment it is withdrawn conscious activity returns, without any memory or idea that any thing has occurred or that any time has elapsed. But unconscious gangliation was not then suspended.*

Conscious gangliation is named Mentat-*ion*, (*Mens Mentis*,) and the four kinds of ganglia are named Mentat-*ory*. It seems to be the ripe fruit of the unconscious gangliations,

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*Other facts bearing upon this point will in their places be recited. The writer once had the opportunity of seeing a person experimented upon. The upper back parts of his brains were exposed by accident. The slightest pressure suspended consciousness even in the middle of a word that he was speaking, which he finished when the pressure was removed.

not only of these but of all the ganglia, the most remote also, at least at times, participating. Many unconscious, are necessary for producing each of the conscious gangliations. Persons go to bed without, and wake with clear ideas of subjects. Incipient kidney disease, unknown to the person, often excites the conscious gangliation that life is precarious. Imminent apoplexy usually excites a conscious foreboding of evil, and makes the person timid about going into places where falling will be hazardous. He does not, but his doctor does know what that indicates. Premonitions are therefore often the best of indications.

Unconscious, takes place much quicker than conscious gangliation, or it exhibits its action much quicker, doubtless because in conscious gangliation the action must take place through the uppermost ganglia, and by a secondary process.*

Shall we then look upon unconsciousness as the slightest sign of death, or for consciousness as a sign of restoration, and be discouraged if it does not soon appear ? In fact, as it is the first to go it is the last to return. Before it will be in order, many, very many unconscious gangliations must do their quiet unperceived work. Because we do not see any movements it must not always be inferred that nothing is going on. Nor must we expect to see in the action of the heart, nor in breathing, signs of the working of the ganglia, until we have thoroughly provided for it by restoring the temperature of the ganglia. †

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*The character of unconscious gangliations is curiously shown by the somnambulist, (sleep-walker,) who goes in safety into hazardous places, but if awakened into conscious gangliation is in jeopardy. A simple method of breaking up his habit is to spread a wet strip of carpet, or a corresponding strip of sheet metal by the side of his bed, so that when he puts his foot out upon the cold article the shock will awaken him.

† This is supposed to be naturally a little higher than that of the mouth or armpit properly covered. That of some ganglia may differ from that of others. It will be about 98° or 99° in some. Other parts of the Body vary from those temperatures ; from 100° in some parts, down to 96° to 94° in the hands, and to 94° to 92° in the feet, healthy and properly protected.

The upper parts of the Brains are shown to be double by Figs. 18 and 21. If equally vigorous by inheritance, training, health and use, what one can do, the other can, in kind and degree. One is usually the weaker; hence right or left-handedness. Usually the same idea applies to the whole side, but a man may be right-handed and left-footed. The eye-lids of the right eye usually are wider open, and the muscles of the right face more active; the right cord of the larynx is then stronger, producing a raucous voice. A smooth voice indicates a balance of power in the twins—an ambidexter.

This subject is so interesting and important that it is worth illustrating, hence I have introduced the following Figure and description.

FIG. 25.

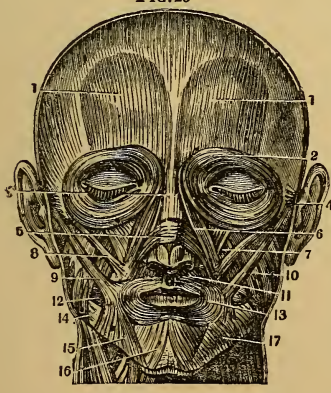

Fig. 25.

Fig. 72 represents the muscles of the face, all of them evidently being double, except 13, which is also double, the tendon at the middle line of the upper and lower lips, perfectly though thinly, separating the right from the left. If a person's right or left facial muscles are paralyzed, he will be able to use only the other muscles of the face including that of both lips from the middle line, and by a little practice any person can exhibit the action of the lips of one side in talking while the other is quiet. Fig. 49 also shows that each group of muscles has its own nerves.

In the above Figure the muscles are represented in exact balance. The person with such muscles will be ambidexter, have a smooth voice, etc. If the left brain is the stronger, the muscles of the right face will be the stronger, the more lively, and more "expression" will be there ex-

hibited; it is the right side of the face to be photographed.

This Figure also shows that the muscles are in pairs, or twins, and in connection with Figure 20 will conclusively impress the mind with the correct idea that the nervous centres which control the muscles must be double, or twins.

The weaker side needs especial attention in restoration, it must receive more heat, rubbing, etc., while the stronger chest must be chiefly relied upon in artificial respiration.

The twinity of the Mentatory Ganglia gives rise to double consciousness. Some restored persons say that when drowning there seemed to be two of themselves, of whom one became unconscious, or, as they say, "seemed to drown" first, showing that the activity of one brain subsided first. We often notice that an intoxicated person argues aloud with himself. Most persons do this silently. The apparent nonsense of the insane can sometimes be separated into two correct sentences. A person may be in two states of consciousness, at different times, having two distinct memories, etc.*

When the writer once used morphine he seemed to hear two bands playing,—one string, one brass—he seemed to hear one with each ear. A well trained person can hear distinctly two strains of music, can listen to two discourses, or to one and to a piece of music, or can listen and read at the same time. But no man is ever in three states.†

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* It is unfortunate that the brain has been named as if a unit, and that what should be named right and left brains have been named hemispheres, as if halves of a unit. The erroneous use of words induces erroneous ideas, and prevents the development of correct ones.

† Dr. Wigan, of London, in 1842 published a book entitled "Duality of Mind." Only a few copies reached this country. I had one myself. If any one knows where it is, or if any copy is for sale, please inform me, as I wish to try and get it published. One copy is in the Library of Dr. Brown-Sequard, one in the Mercantile Library of this City, and one in the Atheneum Library, Boston. Its reading will repay much trouble. Sir Henry Holland wrote a very interesting article about the same time, taking a little different view from that of Dr. Wigan. Holland's works are in the New York Hospital Library.

As all nervous power arises from nervous cell activity, the number of mentations, as well as of unconscious gangliations, must depend upon inheritance, proper temperature, and essentially upon the richness of the blood and the rapidity of its flow. Deficiency in either of these two will depress cell activity all the way from "not very bright" down through stupidity, sleepiness, hibernation, to suspended animation, or complete stupor.

Again, these conditions may, and all the time do, exist in some ganglia, (at least with rare exceptions.) Few men have the blood necessary to sustain the activity of all parts of the Body at the same time. Indeed few men can at the same time sustain the activity of all of both sets, or even of one set of Mentatory ganglia. There are few Shakespeares, in whom the mechanism for blood-making, and the mechanisms for blood-using are reciprocally large, active, and vigorous. Usually if the stomach is full fed, blood must be withheld from the brains, and the person will feel dull or sleepy. Infants and old people wish to sleep after eating, their blood being needed largely by their stomachs. When one Mentatory ganglion is intensely active, usually it withdraws blood from the others. Sounds are not then produced, pains cease, etc.*

Sudden intense activity of the Mentatory ganglia will sometimes even withdraw the blood from the vital centres below, stopping the breath and the action of the heart, causing what is falesly named sudden death. Action is merely suspended, it should be restored. Fright when drowning may have the same effect, and complicate restoration. It must be remembered that each microscopic nervous cell, when active, is a chemical suction and force pump, drawing

* Toothache is seldom felt in business hours, and is usually at once dispelled by the sight of the Dentist's tools, which intensely excite other ganglia than those connected with the teeth.

material from the blood and throwing them back when effete. As there are millions or billions of these cells in a ganglion, their aggregate power over the circulation is very great, and they will draw the blood from other parts less active naturally, or for the time being. Many students know that close study is attended with cold feet, the "blood being drawn to the head."

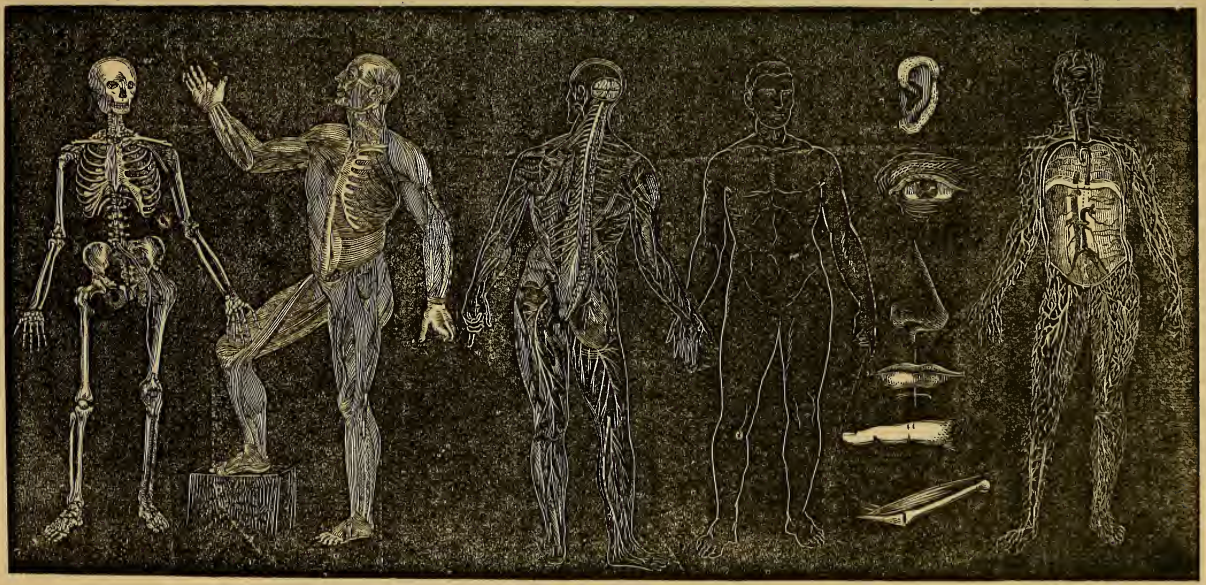
Again, various drugs passed into the blood will excite the activity of the cells of one ganglion or of several, and intensify consciousness, while other drugs depress activity and obliterate consciousness. Apoplexy and congestion of the blood-tubes of the brains produce depression ; also some poisons, alcoholics for example, first excite and then depress activity, even to stupor, not merely of the Mentatory ganglia but of the Vital Centres, which interferes materially with restoration from suffocation, for which, as has been seen, we are obliged to depend upon the activity of the Nervous Centres, which cannot be aroused when depressed by drugs.

THE CRANIO-SPINAL DOMAIN

is very finely illustrated by the several sketchy Figures on opposite page. Fig. 26, Skeleton. Fig. 27, Muscles that move the skeleton. Fig. 28, Nervous Centres and Nerves that control those muscles. Figs. 29 and 30, Skin and organs of sense, which through nerves excite to action the centres of Fig. 28. Interweave these figures so that in the mind's eye they make one figure, and the domain of the Cranio-Spinal Nervous System will be complete, except the domain of the Vital Centres, which is found in the Muscles of the blood-making organs, located in the Trunk, as shown in Plates 6 and 7.

(The figures of the opposite page afford a very profitable study of the structure of the Natural Divisions of the Body. The arm, for example, is constructed of skeleton (Fig. 26),

Fig. 26 Fig. 27 Fig. 28 Fig 29 Fig. 30 Fig. 31



muscles (27), nerves (28), skin (29), blood-tubes (30). The leg, trunk-walls, neck, and the head-walls will show the same structure. Then notice the contents of the head-walls and of the spinal column—brains, spinal-cords (28), ear, etc. (30). Observe, Fig. 26, that two divisions have Walls and contents thereto : the firm Head-Walls and the flexible Trunk-Walls. These form two cavities. Fig. 27 shows that the muscles are mostly outside the skeleton ; Fig. 28 shows that the ganglia are inside the skeleton, and with Fig. 31 shows that there are two Centres, the brains and the hearts, each communicating with all parts of the body, one by means of the nerves and nervous influence, the other by means of the tubes and blood. Thus by studying the various subjects illustrated by the Figures of that one page, a very good knowledge of the general structure of the cranio-spinal domain will be made familiar.

THE NERVOUS CIRCULATORY (SYMPATHETIC) DOMAIN.

All these parts must be kept in good condition by an ample supply of rich blood which must be brought into the vicinity of each minute portion of the active tissues by myriads of blood tubes (Fig. 31), channelled throughout those Tissues. The arterial blood-tubes (Fig. 19), are an independent domain under the Circulatory Nervous Centres (*d*, *d*, Fig. 17), entirely involitory and unconscious. These are appropriately named, since they are found in animals which do not have any Cranio-Spinal Nervous System, but never in animals which do not have—and always in those which do have —a circulation of blood. This demonstrates their use to be the regulating of the circulation of blood, not simply through a single part of the body in accordance with its needs, but perchance also through some distant part in furtherance of the same object; for example, when the cheek is flushed with blood upon exposure to the cold, the circulation of the blood

through the kidneys is also increased, that they may draw off a part of its water, and thus cause heat to be produced and circulated more rapidly, in accord with the need of the exposed part. The ganglion which regulates the circulation through the cheek may not be connected directly with the kidneys, but may have to exert an influence upon them indirectly through other ganglia.

As the volitory mechanisms are double or twins, so the blood-tubes which supply them with blood must be and are practically in pairs, right and left, (see Fig. 19 and Plate 6). But, as the blood-making mechanism is not double, being practically constructed of single organs, hung upon the spinal column, inclosed by, but not attached to, the walls of the trunk (Plate 7), so must the blood-tubes leading to these organs be, as they practically are, single. Hence, the circulatory nervous system must be, as it is, single in regard to the single organs of the blood-making mechanism. For this purpose nerves extend from both the right and left chains (*d*, *d*, Fig. 17) toward the centre of the trunk in front of the backbone and behind the organs hanging upon it, and there interweaving with each other, with the additions of some gray, cell, or gangliatory tissue, form the three large plexuses (see Fig. 17), which become, so to speak, new single centres of influence to be exerted upon, and to control the circulation in the blood-making organs. This view is also supported by the fact that the kidneys are double in one sense, and each is, as it should be, related to its own chain, since by exposure of the skin of either side of the Body to cold the corresponding kidney should be excited to action. They are not, therefore, placed under the supervision of any unitary plexus of the abdomen. Indeed, they do not properly belong with the commonly named contents of the abdomen. They do not hang upon the spinal column, are outside of the lining of the abdomen,

and attached closely to the walls of the trunk, having no connection with nor relation to the blood-making organs. The kidneys are placed where they are that they may be the least liable to be exposed to changes of temperature, that they may be near the common receptacle of their eliminations, and for other like reasons of convenience of arrangement. Their action, like that of the perspiratory tubes, is wholly involuntary, although the emotory ganglia can, indirectly, through the circulatory ganglia influence the action of both, as is often noticeable.

The vitality of any part is plainly dependent upon the circulation of good blood through it, and as each of the circulatory centres extends its nerves along the arteries leading into certain parts, each ganglion has its own kingdom, which can act upon the ganglion and cause its reaction upon itself, or its action upon one, or more, of the other ganglia of this system. These ganglia differ from each other in their vigor; hence, different parts of the Body are supervised with different degrees of efficiency, according to the inheritance, development, and health of the several supervising centres. Thus, very many persons "take cold" in one part of one side easier than they do in another part of the same side. As these ganglia are twins, right and left, one will be apt to be the weaker. Such persons often say that their left foot becomes cold before the other one does; yet they do not clothe that side the warmer as they should do. If a leg is shorter, the tailor or shoemaker will see to it, but if colder neither provides for its protection. The whole of the weaker side should be the more warmly clad.

Thus is easily solved the very interesting problem that to many is an enigma, namely, why different vitalities and longevities usually exist in the same person, and even in different parts of the same person. The vitalities belong essentially to these centres as longevities do to the Secretory Tis-

sue. Every part of the Body has its own longevity in itself, so to speak, but its vitality is dependent upon the ganglion that controls the circulation of blood in it. Hence, the vitality may be strong in a part which has great longevity, or it may be weak ; and in the same person one part may have great vitality and inferior longevity, while a part near by may have inferior vitality but great longevity, etc.

Again, it is important to notice that the two grand Nervous Systems indirectly influence to a degree the domains of each other. The Cranio-Spinal System affects the circulation of the blood through its nerves penetrating the ganglia of the Circulatory System, while, depending upon blood for its activity, it must depend upon the influence of the Circulatory Nervous System. Hence, we see that the emotions affect the circulation of blood in the skin, paling the cheek or mantling it with blushes ; the thought of delicious food will quicken the circulation to the glands that secrete the saliva, increasing its amount, making the "mouth water." Dr. Beaumont saw the gastric juice flow more freely into the stomach of Alexis St. Martin when he was good-natured, while the flow would be suspended if he were annoyed, especially if he became angry. But as the will cannot directly control the circulation, the "crimson of modesty" cannot by any artifice be called to the cheek of a person in whom refinement does not exist. Character cannot be "put on" so as to deceive the discerning; it must be put in, and then, through unconscious gangliations, it shows itself without effort.

SUMMARY OF ACTIVE TISSUES.

A review of these confirms the idea that there is nothing in their nature which militates against, but that everything favors their restorability when drowned, or otherwise simply suffocated. This conclusion, thus deduced, is confirmed by

every authority, all, without an exception, agreeing and insisting that life does continue for a longer or a shorter time after suffocation, apparently waiting for the aid which every person should be taught to give to the unfortunate. The only question debated or debatable is the length of time during which animation is restorable. If this truth of restorability, during no matter how short a period, can be impressed upon the public, lay and professional, "a consummation devoutly to be wished" will be reached, since many a life will be saved under that belief which will be lost under the belief now prevalent. This will be no mean result. One of the able editorial writers of the *New York Express,* says :

"The great interest of all people is health. *How to save life* [the italics are mine], and to extend its duration, and increase its value to its possessor and to the community, are the great questions of science, of statesmanship, and of humanity."

Nothing better could be said, and nothing could be better said.

For what purpose is all our agriculture ? Unwittingly to the farmer, the objective point is the improvement of human brains. The review of the Active Tissues show that they all demand air, water, food. The former two are free to our hands. The last is two-thirds of all our labors, the best food being the result of the most intelligent labor, and going to the development and activity of those ganglia upon which the intelligence producing the food is dependent. Food is also needed to sustain the essential heat of those Tissues, for which also clothing, shelter, and fuel (more labor) are required. These constant labors, if properly done, give much enjoyment in the doing as well as in their results. Was not then the writer of the above-quoted lines right ? Certainly. More wisdom was never expressed in the same number of words. They should be the lesson of every child until impressed indelibly upon its mind.

Mr. Lancaster, of *The Evening Telegram*, than whom no one writes more wisely, tersely, and clearly, in a recent brief article of singular value, indicates the result of endeavoring to preserve life, by saying :

"If the wisdom which consists in keeping the mind and body in a sound condition were universally possessed, men and women generally would live to be an hundred years old, instead of dying at forty or fifty."

He closes with a paragraph so fraught with truth, that I cannot forbear its insertion, in hopes of saving some man's life. I am not aware that the same ideas have ever before been presented to the public, yet they are "as true as the gospel," and explain why there are more very old women than there are old men :

" * * * It is not only young people who are careless of health and strength. Old people are often quite as imprudent. In fact, obstinacy in exposing one's self, insufficiently protected to all changes of the weather is sometimes one of the characteristics of old age [and of ill health], and in not a few cases proceeds from an unwillingness to acknowledge that such precautions are then necessary. A man well stricken in years not infrequently feels a certain pride in proving with what impunity he can maintain something of the recklessness of youth. Although he does not know quite so little about the needs of his body as he did at eighteen or twenty-five, he is not his own sufficient physician, and never will be. To take care of one's self, like every other course of conduct in which reflection and experience are necessary, is an art, and few be they who therein excel."

This matter is not of less importance in the restoration of the drowned. A review of the Active Tissues indicates that if they are well constituted, fed, clothed, housed, and their health good, they will recover from the effects of suffocation much easier, and with more certainty, than they will if their powers are exhausted by "riotous living" on one hand, or by underfeeding and overwork upon the other, or than they will if the Body is naturally weak.

Some intelligent reader, making a review of the Active Tissues, may suggest that their *rigor mortis*, the coagulation of the blood, and the lymphatics have not been discussed.

The first two will be noticed in Appendix. The lymphatics I class as an extensive tubular gland (see figures* on opposite page), lined with secretory tissue secreting lymph, and pouring it into the blood. They are not found in the Nervous, nor in the Secretory, but abound in the other Tissues, as shown by the figures. What the use of the lymph is, or the need of the lymphatics, strange to say, after hundreds of years of study of them, is not yet settled. But as no one has reproached them with preventing or retarding the restoration of suspended animation, this brief notice of them must suffice.

A HIERARCHY.

A brief review of what has been said compels the suggestion of the idea that the Body is a Hierarchy. The PASSIVE are subordinate to the ACTIVE TISSUES. The *Secretory* and the *Musculatory* are subordinate to the *Nervous Tissue;* the Circulatory Nervous System is subordinate to the Cranio-Spinal; the Spinal to the Cranial; while the Sensatory and Motory ganglia are subordinate to the Emotory and Intellectory ganglia. These, by means of the Sensatory ganglia and Nerves, reach out into all parts of the Body, into the outside world, and even into the universe, from all of which they bring to themselves knowledge. While, on the other hand, they reach out by means of the volitory (motory) ganglia and nerves, and execute their mandates within the Body, and as far as possible upon the outside World.

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* Fig. 32 shows the lymphatics—both tubes and glands—of the body generally, opening into the veins of the neck. Fig. 33 shows specially the lacteal-tubes leading from the intestines to the veins of the neck. Fig. 34, the lymphatics of the thumb very much magnified. Fig. 35, lymphatics in a frog's foot.

Fig. 3.

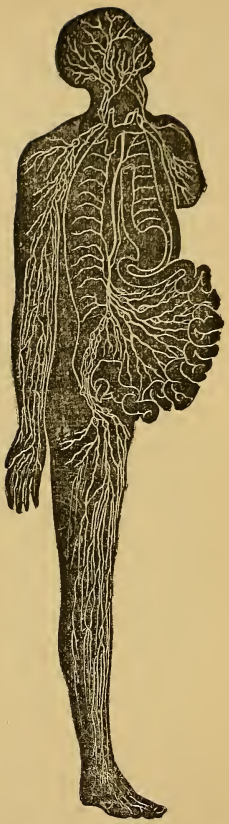
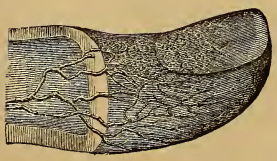


Fig. 4.



A hundred years ago, a noted writer who knew nothing of physiology, but who had shrewedly observed the actions of men, said, "Man's character is formed of his ideas and feelings." These correspond to the emotory and intellectory ganglia, which are therefore pre-eminently the physical man, the climax of the Hierarchy. Their functions indicate, that "to know" and "to love" are his duty and his happiness; at least he should know how to treat the common and necessary accidents of life, and with loving-kindness should be anxious to aid his fellow-men in every calamity.

This is the lesson taught by the Human Constitution and its properties, by the Human Structure and its functions. Is it then probable that death will be the cold reward of man's noble and intelligent efforts to bless his fellow-man by restoring him to animation? Humanity, philosophy, and science so far as known, forbid such a conclusion, while experience raises the banner of hope and faith, a sanguine prophet of complete ultimate success.

Appendix.

THEY ARE NOT DEAD.

ADDITIONAL AND INTERESTING PARTICULARS BY THE HIGHEST AUTHORITIES.

Suffocation does not mean immediate death—Indications of death in other cases sometimes mistaken, and persons are buried alive—Its true signs—Cases of restoration by "heat method"—Other methods discussed—Questions answered—Special treatment of the drowned and of those suffocated otherwise—Choking—Strangling—Hanging—Smothering by clothes, caving earth, crowds, etc.—Stifling by smoke, poisonous gases, etc. —Freezing—Cold—Trance—Lightning, etc., etc., etc.

Webster gives the definition of Suffocate, "To choke or kill by stopping respiration." Suffocation, "The act of stifling, destroying, or extinguishing." The great Lexicographer here, as so many others do in this and other cases, assumes that to be death which is not death. "To suffocate" is not to kill, *per se*, death never occurs immediately upon suffocation. This is not the same as saying that all suffocated persons can be restored to animation; it is only saying that no one is yet dead who has been recently suffocated.

But the idea of Webster is so inwrought in the public mind that most of the suffocated are allowed to die, as without aid they usually will, although enough "come to" without aid, to suggest, it would seem, that the general opinion is erroneous. The true signs of death being generally unknown, some apparently dead, otherwise than by suffocation, are assumed to be dead, and in too many cases are buried alive.

ASTOUNDING FACTS,

Which, through a medical friend, recently came to my notice, in regard to the number of persons who were drowned yearly in New York alone, considered dead, and no pains taken for their resuscitation, and the still more surprising number, though not so large, of those who probably are yearly buried alive,—and as every person is liable to each of these dreadful contingencies,—so largely increased my estimate of the importance of those subjects that I wished to ascertain if my views were really correct, or were exaggerated. The gentleman to whom I wrote, and whose answer is below, is held by all who know him to be one of the first scholars living, especially in all departments of science, particularly physiological science, and as having a judicial mind of rare ability. I did not at the time know that he had written any thing upon the subject, nor had he then been a witness upon a branch of the subject. I therefore took the liberty of addressing him, knowing that if I was wrong he would put me right, if I was right that I should be confirmed by his additional arguments. I did not, although I know his public spirit, expect that he would take the pains to write so long and interesting a reply, so pregnant with the most valuable truths. It should so profoundly impress the public mind as to entirely reform the wrong customs which he condemns. He is entitled to the warmest thanks of the public for this valuable contribution.

LETTER FROM P. H. VAN DER WEYDE, M. D.

(*Editor of The Manufacturer and Builder.*)

T. S. LAMBERT, M. D.,

Dear Sir :—In reply to yours I will say, that for many years I have held the opinion that the symptoms of a cessation of the circulation of the blood, and of respiration, which, according to the popular belief, indicate death, are by no means sure signs of the extinction of life. I hold that the suspension of the functions named by some cause or

other simply produces at first an inert condition, usually, but not always, accompanied with unconsciousness, a coma, which in most cases will finally result in true death, but which in more cases than even the average medical practitioner is aware of, can be successfully interfered with, and real death prevented, by proper measures tending to restore the functions named.

FATAL ERROR.

The belief that death is instantaneous when no vital parts have been damaged, and the system has suffered no other injuries than such as are caused by a mere cessation or respiration, and of circulation, is a most fatal error, which it is a duty to exterminate. When, for instance, a person has fallen into the water, and been totally immersed for say ten minutes, he will show no ordinary signs of life when taken out, and in case insufficient means of resuscitation are employed, or, as is most always the case, nothing whatever is done, it will be said, "the man was dead when taken out." Now, we have no right to say this. Even after an immersion of half an hour, there are many cases on record proving that proper and persistent effort to restore respiration have resulted in resuscitation, preventing death, which, without these means would surely have followed.

EXPERIMENTAL PROOFS.

Experiments with dogs, cats, rabbits, frogs, fishes, and other animals, have convinced me that in a multitude of cases death is only apparent, and life may be restored under conditions which appear almost like a resurrection from the dead ; I have even succeeded in restoring to animation a large fish, bought in the Fulton-market, and intended for the table, being to all appearances dead,—drowned in the air as man is in water. It was placed in water and electric currents properly applied, and respiration by the gills, and active circulation was successfully restored. Vivisection, especially of dogs, under the influence of chloroform, has convinced me that if any one succeeds in inflating the lungs with atmospheric air, circulation and animation may be restored, even in cases in which mechanical injuries to the animal may be so serious as to make continued life an impossibility.

I have had a few opportunities to test my ideas with success on persons saved from drowning, and I am perfectly satisfied that if a proper apparatus were constructed to make the introduction of pure air into the lungs a certainty, scores of lives

could be saved in cases of suffocation by drowning, hanging, carbonic acid, the careless use of anæsthetics, and in cases of suspension of life functions by coma, etc., etc.

MISTAKEN INDICATIONS.

Fainting fits are too often mistaken for death, for instance, a person sick in bed faints—or this may happen to a person not sick in bed—those present observing no respiration, with good reason become frightened, and send at once for a doctor; he feels the pulse, listens for the beating of the heart, and seeing that circulation has ceased, pronounces the person dead. The undertaker is immediately sent for, and if the relatives are able to pay for it, the body is at once put upon ice; in this way, perhaps, the remaining spark of vitality—which by non-interference, or by proper treatment, might be rekindled—is utterly extinguished by the cold, and true death results.

Dr. B. W. Richardson, in a paper lately published in *Nature*, states that "young cats, that have been drowned in ice-cold water, will, after two hours' immersion, almost to a certainty, recover if brought into dry air at a temperature of 98° Fah." He adds: "the gentlest motion of the body will be sufficient to restart the respiration and therewith the life."

The question of resuscitation from apparent death has lately arrested the attention of physiologists. The eminent scientist just mentioned has published a most interesting article, which shows that the pretensions recently made, about the possibility of suspending the functions of life for a certain period, and effecting afterward an apparent resuscitation, must not be put aside as utterly groundless. He says, "All the vital acts may be temporarily arrested, and some animals may continue apparently dead for long intervals of time, and may yet return to life under conditions favorable to recovery." He then mentions, that in one of his lectures he resuscitated fish which in winter had apparently been completely frozen to death, and sent to him by rail; they were produced in the completely frozen state at the lecture, and by careful thawing many of them were restored to perfect life.

DANGEROUS EFFECT OF ICE.

Considering the pernicious custom of putting bodies upon ice, —so much encouraged by undertakers—and the statistics of those burial grounds in Germany in which peculiar precautions are taken to prevent premature burials, I am satisfied that in

New York City at least one in a thousand persons are buried before they are thoroughly dead, and which by proper means could have been restored to life ; so that of the 30,000 persons who are buried yearly in New York City, at least 30 are buried alive, some of whom come to consciousness again when lying underground in the grave, where the temperature is always comfortable, in winter as well as in summer, and much better adapted to restore the vital functions than is the ice on which they were kept as long as they were above ground.

TRUE SIGNS OF DEATH.

The questions naturally arise : 1st, How soon does true death follow after the cessation of the usual functions of life ? and, 2d, What are the symptoms by which real death from which there is no hope of resuscitation, may be infallibly recognized ?

It is a great misfortune to mankind that such erroneous notions prevail in regard to a subject of such "*vital*" importance to everybody. The probability of recovering consciousness by an individual buried in his grave, is a most frightful theme to contemplate, and it is a disgrace to the medical profession that they have not obtained clearer ideas about it, and diffused them among the public. I say this with emphasis, as in several articles on apparent death, lately published in the leading daily papers, and some of which were written and signed by medical men, all the symptoms mentioned by them were utterly worthless, and based on the erroneous theory that a cessation of respiration and circulation was a sure sign of death, while the only true and reliable symptom was not mentioned at all in any of these articles.

Cases of total suspense of these functions, and consequent restoration, are abundant enough to dispose at once of any theories. There are even cases on record in which the victim of suspended animation was fully conscious, and heard all that was going on, felt that he was laid out, and placed in a coffin, but unable to move a member of his body, or utter the least sound, like one under the influence of an aggravated case of nightmare. We know of a case where such an individual was after exhaustive efforts at last enabled to move a finger, this was fortunately noticed, at once proper measures were taken, and life was restored. How many individuals are conscious of what is going on while they are carried to the cemetery ? That is the question. Who can answer it ?

The theory referred to, that when respiration and circulation

ceases death occurs, being utterly false, it follows that placing a plate-glass mirror over the face to see if any moisture is condensed from the faintest breath ; the tying of a string around the finger to see if it swells or reddens, the pinching or puncturing the skin, etc., are all unreliable, as these tests only indicate whether respiration and circulation are suspended or not.

My theory is that the beginning of true death is the cessation of those functions which prevent the ordinary chemical reactions from exerting their full play in the body. The reactions are decomposition, decay, putrefaction, and they will show themselves soon enough at the place where they always begin, the abdomen ; a greenish discoloration in the region of the stomach, is the earliest sign which will usually appear before the slightest odor makes itself manifest. As this sign is absolutely reliable, we wish that a law had been enacted forbidding the putting of bodies upon ice, and especially prohibiting burials before this important symptom is observed in a corpse, so as to prevent the terrible possibility of a revival after burial.

In a recent murder case I was willing to appear on the side of the defense, not for the reason of any morbid sympathy with the defendant, but for the purpose of bringing the above ideas before the public. Four hours after the crime, the woman was found uninjured, but with suspended respiration and circulation. In place of applying means of restoration, that would have given the woman the advantage of the doubt, and a chance for life, which, even if it was but one in a thousand, was worth trying, an undertaker was sent for who put the body upon ice ; if this was not enough to freeze the last spark of vitality out of the body, a *post mortem* did the rest, and made death sure. Since the *post mortem* showed the blood to be still fluid, the probability of restoration by a proper treatment appears to have been much greater than we should suppose it to be if they had found the blood coagulated.

That four hours are not long enough to warrant us in giving up attempts to restore life has been proved over and over again. Such a case is on record in which efforts for eight hours restored life, namely, twelve hours after suspension of animation ; while spontaneous restoration after even two days has been recorded in more than one case.

Respectfully yours,

P. H. VAN DER WEYDE, M. D.

New-York, *July* 29, 1879.

I will now give the testimony of Dr. Richardson upon the signs of death as given in the article * cited by Prof. Van der Weyde, and a number of very suggestive (condensed) extracts upon the reanimation of animals, published very opportunely for the readers of this work.

DR. B. W. RICHARDSON'S TESTIMONY.

The time during which an animal body may be capable of reanimation depends upon whether the blood, and the muscular fluid, and the nervous fluids remain in what I have defined in another essay as the aqueous condition [whether the contents of the muscular and nervous cells have remained fluid], or have become pectous [jelly-like, from pectin]. If aqueous, the life-restoring period may be weeks or months, if decomposition of the Tissues does not occur; even after a limited decomposi-

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* *Nature*, May 29th, 1879, (Macmillan & Co., Bond St., New York, single numbers 15 cents.) It is one of the most interesting, valuable, and suggestive articles of the prolific pen of Dr. R., and well worth to any one all the cost and trouble of its perusal. He wrote it on account of the printing by the *London Times* of an article from the *Brisbane Courier*, Australia. It was partially or wholly copied by several New York papers. The gist of it was that some chemist had discovered a subtle substance which, injected into the ear of an animal caused the suspension of its animation, then it could be frozen and kept in that suspended state until a time when it was desirable to have animation renewed; the animal being thawed received also another injection of an antidote, which restored it to full activity. Thus animal food could be carried in prime order to England or elsewhere. The ear-marks of invention in the story are as conspicuous as those of a donkey. Dr. Richardson improved the opportunity not only to point them out, but to state what had really been discovered in regard to suspended animation. No one is better adapted, since, as he says: On the subject of suspension of animation I have been making experimental inquiries for twenty-five years, and have communicated to the scientific world many essays, lectures, and demonstrations relating to it. In the lectures delivered last year before the Society of Arts, I dwelt particularly upon the preservation of animal bodies for food, and that research must ultimately reach to a process by which the bodies of animals should be kept in a state of suspended molecular life. (By molecular he means the compound or anatomical elements which constitute the several Tissues.) He remarks "My faith was most shaken by the statement that the agent used to produce suspension of animation is a secret, since men of true science know no such word." A noble sentiment! He concludes the article cited, by predicting that the science of preserving life is on the very eve of "GREAT EVENTS, WHICH THE POSITIVE RESULTS ALREADY SECURED DEMONSTRATE ARE SURE TO COME, AND WHICH THE WORLD SHOULD BE PREPARED TO EXPECT, AND WITHOUT AMAZEMENT TO WITNESS."

tion there may be reanimation in cold-blooded animals. But if pectous change begins in any of the fluids, it extends quickly through all the structures, and recovery is impossible, since the pectous change in one part will prevent the restoration of any.

There are agencies which will reduce life to the very low ebb necessary for its suspension. Cold is the most efficient of these agencies. At the freezing point all vital acts may be temporarily arrested in an animal, which may continue apparently dead for any length of time, and yet, under favorable conditions, be restored. The body of even a warm-blooded animal might be brought down to a condition so closely resembling death, that the most careful examination may fail to detect any signs of life.

In a large drug-store a cat was killed, as it was assumed, instantaneously, and without even a pang, by a large dose of Scheele's acid. At night the animal was still lying apparently dead, the next morning it was alive and well.

The wine of Mandragora will suspend active life. It was the *morion* of the ancients, and probably used by the Jewish women to prevent the suffering of those under torture, and perchance to deceive the executioner, and to rescue his victim.

I attended two children poisoned by eating the berries and leaves of nightshade. They were brought home insensible, and lay with life suspended for seven hours, and then recovered.

Pigeons put to sleep by the agency of chloral, had such a complete resemblance to death that, among our audience, including many physiologists and other men of science, they were thought to be dead. I could not detect any sign of life in them, and they were laid in one of the out offices. But the following morning they were alive, and as well as ever.

I showed that the life of a frog might be suspended for nine days [even for more time] followed by recovery ; that suspension for a shorter time could be produced in a warm-blooded animal ; that its heart would contract eighteen hours after an apparent death. The Nitrite of Amyl prevented the pectous change, namely the *rigor mortis* of the muscles, the coagulation of the blood, and the solidification [or *rigor*] of the nervous system, and while this change was suspended recovery was possible.

Alcohol is another substance which holds the vital functions

in suspense for long periods of time, the muscles retaining their excitability. In case of animals killed by alcohol, in combination with cold, two influences which act powerfully in the same direction, I found that the muscular excitability could be retained at freezing point for several hours.*

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* A few days since, the writer was by chance riding in an omnibus wagon, along an avenue, on the bluff overlooking a beach, when it was stated by the driver that the crowd that we saw on the beach was around a man drowned about an hour before, "a man of no account, not one of the visitors," he said. I considered it, as Dr. Garrish remarks, "the bounded duty of every man to do all in his power to save life, it matters not whose it is." I therefore got out to view the body. I saw nothing to discourage the idea of restoration, except that two policemen were afraid to allow the body to be moved until the Coroner came. They were, however, such well-disposed men that after half an hour's persuasion they concluded to take the risk. One went to find a place, and the other directed the carrying of the body to a carriage-house of one of the hotels. All the circumstances were unfavorable, but we did the best we could. Blankets were brought and laid under and over him, and other parties brought water, sometimes hot enough, but mostly merely warm. The Coroner soon came. He was a kind-hearted gentleman, who at once rendered all the assistance in his power, as did all about us. After we had worked an hour, word came to us that the man had been intoxicated all the forenoon, and was so when he went into the water. At once several very peculiar indications were explained. I had no longer a full expectation of restoration; although I considered it proper to continue my efforts longer, since they might do good, perchance, while they could do no harm. An hour and a quarter more was thus spent when the indications became quite distinct, as I then thought, that he could not, under the circumstances, be restored, although life was not then extinct. It was alcohol only, and its continued depressing effect upon the centres, which prevented his restoration. He was a very finely formed man, stalwart, good face, good head, and a handsome eye. I disliked exceedingly to give him up. It was very unpleasant to think of his dying as he did. But, although I could send the heat into his Nervous Centres, (it was, however, an hour and a half before his throat was blood warm,) yet I could not get the alcohol out of them, that curse of mankind was too powerful.

After much reflection and profound consideration of Dr. Richardson's remarks upon alcohol in connection with cold (exactly this case), I must acknowledge that I feel compunctious for not having done my whole duty, since in time the effects of the alcohol might have passed away, and given the nervous centres a chance to recover. True, *rigor* had occurred in the muscles of his jaws (why does it appear there first?) before I saw him. But I do not see the correctness of the usual conclusions drawn from that fact. There were also reasons for desisting from further effort, that delicacy forbids me to mention. If, again, I had known the Coroner as well when we met as when we parted (he is a very humane man, a true-hearted gentleman), my course would have been different from what it was, and the result might have been different: I should have thought only of my duty to the drowned person. I have resolved not again to have myself to blame. I will act as I think I ought, and demand the best aid that can be had.

See also Dr. Van der Weyde's quotation about cats and fish upon page iv.

ARE "PECTOUS CHANGES" FATAL.

I cannot agree with Dr. Richardson that "pectous changes" (*rigor* of muscles and nerves, and the clotting of blood) are the last steps of departing life, obstinately refusing to be recalled. True, death is usually preceded by them, but not always, nor are they always followed by death. Dr. Richardson, in one of his lectures, mentions a very interesting case of an animal frozen after *rigor* had appeared, which had disappeared when the animal was carefully thawed, and its animation was soon restored. There is, then, no necessary connection nor relation between these changes and death, and the conclusion that there is has been, I think, too hastily drawn. Indeed, Dr. R., in this article, says :

"Much is known by science in respect to the suspension of life by artificial means. Cold and other agents have this power. They also are antiseptic, indicating that whatever suspends life, also, by some necessity or correlative influence, suspends putrefaction. Hence, I draw the inference, that the structures of animals can be preserved in some form of suspended life."

As the children say in playing "Hide the Thimble" when one is very near the hidden thing, "he is very warm." It is hopeful that he will soon be "hot" enough to see and unfold to us the whole matter, and how to proceed for the full attainment of our desire and hope.

But Dr. Carpenter, one of the most eminent of physiologists, also writes :

"Probably coagulation of the blood is the last act of its vitality, as the *rigor* of the muscles is the last effort of theirs."

Indeed, all agree that these "pectous changes" must vanish before the seal of death is absolute, and before putrefaction or dissolution can appear. It follows, then, that

these changes are witnesses of life, not of death, are products of life, and not the work of death. But does any one yet know anything about the conditions of their manifestations? Are they the result of chemical action, or of deficient or of intensified vital action? May not these be the best forms in which life can fortify itself for holding out the longest time possible? If such is the case, what a grave mistake has been made in assuming that they are the sure forerunners of impending death. How do we know that these "pectous changes" are not manifestations of a high vital condition? One fact points that way almost conclusively. If exhaustion have preceded them, or if a person is feeble, their advent is speedy, and its continuance is of short duration. The *rigor* also commences in the muscles of the jaw, as it does in case of lock-jaw. Why is that? Shall we then, knowing so little, act upon any mere assumption that will prejudice our efforts for the restoration of the suffocated? How often the wrong use of words leads to the most erroneous conclusions, especially unfortunate in the case of *rigor mortis*, the stiffness of death, which should have been named, it seems, just the opposite, *rigor vitæ*, the stiffness of life.

However indefinite this brief discussion has otherwise been, two things of the very greatest importance have been definitely and conclusively settled by it: (1) Death cannot be assumed to impend before the "pectous changes" have occurred. (2) Until at least they disappear, life continues. "While there is life there is hope," is an old proverb that I believe is most appropriate just here.

WHAT SHOULD BE DONE.

If these "pectous changes" are so unpropitious as Dr. Richardson and Dr. Carpenter fear, we want to learn how to dissolve their spell.

Dr. Richardson instructs us that the Nitrite of Amyl sus-

pended animation, and the tendency to "pectous changes;" he also instructs us that at least in one instance freezing dissolved them. There is much food for thought in these facts. What did Nitrite of Amyl do that postponed the "pectous changes"? What did the freezing do that broke their spell? There is evidently much to learn that is promising to human welfare.

Orfila states, and he has had the widest opportunity for observation, that he has found but one case among the drowned in which the blood was coagulated—a strong testimony that they were not dead. He does not say how long this condition lasted. It must have been remarkable. This suggests that in drowning the clotting of the blood is suspended as a provision for restoration? Was it prevented by want of oxygen in the blood, by cold, or by some hidden influence? Orfila says, that there was one case in which the blood was pectous. Shall such or any other "pectous changes" deprive a person of the "benefit of the doubt"? Certainly not. Sure proofs, at least, of continued life, they may be reserved or preservative forces, and it may be that their termination is at the very "nick of time" when efforts for restoration will be most easily crowned with success.

A reliable gentleman of my acquaintance told me that where he lived people were in the habit of putting a quart of minnows (small fish for bait) into a two quart jug, filling it with water, stopping it tightly with a cork, and thus keeping them until they were wanted. Upon taking them out of the jug, they appeared lifeless, but upon throwing them into water, in a few minutes they were as lively as ever. They were practically drowned, that is suffocated, by having so little water that the oxygen in the air in the jug was exhausted in a few minutes at most, and animation could exist no longer. Did suffocation prevent "pectous changes" in them for hours, or even for days?

THE ONLY RELIABLE SIGNS OF DEATH.

It appears, then, that the only sure signs of death on which all agree, are those stated by Prof. Van der Weyde. Until those indubitable signs are evident, in all cases in which a person's death is caused by accident, unattended with destructive violence, active efforts toward recovery—prolonged and hopeful beyond any reason, and even against all hope, as most will now think—should be perseveringly made. Eight hours and a half were required in one known case. Why not nine, or twice nine hours, in another? Review Dr. Richardson's cases, and let them impress how long animation can be suspended before it is ready to be restored,—twelve or more hours. He also remarks upon the "unexplained feat of the prolonged living burial of the East Indian Fakirs." If animation can be so long suspended before it is ready to be restored, why, when it is suspended by suffocation, will it not come at our proper call and persuasion? If it will not wait upon us, we must wait upon it; but wait with the most active persuasive efforts that we can make. Let every thing be done that would be done if every one felt sure that the person was alive, and ready to respond to restoring efforts as soon as possible. Let him be regarded as a watch that has stopped but is not broken, not needing repair, but merely by heat and like simple treatment to be set agoing.

It is not to our credit that we do not know how to restore all who are restorable; it is discreditable to our intelligence, or to our humanity, that so few of the suffocated are restored, while it is disgraceful that no attempt is usually made to restore them, and that it is certain that many easily restorable are left to die above ground or are buried alive.

So many of those dying from age or sickness which was fatal, have been reanimated for a few minutes, or for a few hours, that it is always wise and safe to keep the person

warm until the certain signs of death are indisputable ; it is then soon enough to chill, freeze, or to embalm the Body.

ADDITIONAL AND CONCLUSIVE PROOF.

As the modern advocacy of restorability of many of those assumed, without complete reasons, to be dead, has been criticised as sensational, even the admirable paper of Dr. Richardson having been so stigmatized, I will extract some testimony from that gravest of authorities, and the furthest possible from being sensational, *Taylor's Medical Jurisprudence,* a work of great repute among all the members of the medical and of the legal profession :

" This question [when does death occur ?] is of great importance in relation to the drowned. The insensibility resulting from drowning will give to a body immersed only a few moments the appearance of death ; but we are not, therefore, to desist from applying every means in our power to restore animation. It is only an act of humanity that means should be applied without delay, even to persons who have remained so long in water as to afford little hope, physiologically speaking, of ultimate restoration. A man who neglects the use of such means, consigns the body to certain death ; while by the right course he may, even unexpectedly to himself, resuscitate a fellow man. Hence, we must not allow ourselves to be influenced in the treatment of the drowned by the period at which death ordinarily occurs. The susceptibility to restorative efforts may be different in different persons. * * * * One of the most remarkable cases on record is that of Dr. Douglass. The individual had been under water fourteen minutes ; no signs of animation were seen until the treatment—which was simply the application of heat and constant friction—had been persistently used for eight hours and a half ; then the [apparent] resuscitation began to be fully established. There is no doubt that this case would, by most persons, have been abandoned as hopeless long before this period. Perhaps many have been lost [buried alive] who were restorable under perseverance."

DR. TAYLOR'S METHOD OF RESUSCITATION.

Let us now see what restorative method this eminent Medical Jurist recommends :

"(1) Wipe the body dry. (2) Keep the head and shoulders raised. (3) Restore the warmth of the body by hot blankets, bottles of water, or bags of sand, or by a hot water or air bath; apply heat especially to the feet and region over the stomach. (4) Apply stimulants (ammonia, etc.) cautiously to the nose. (5) Having cleared the nostrils and throat, move the chest to excite respiration. (6) Rub trunk and limbs, with hot flannel, wet with stimulating embrocations.

Much difference of opinion exists about the propriety of attempting artificial respiration. Mr. Woolley, a medical assistant of the Humane Society, of great experience, denies its utility. In his successful cases he has not inflated the lungs. He is corroborated by Dr. Douglass [case above cited]. It is commonly tried, and it is said successfully; but at the same time other means, which alone have proved effective, have been used. Hence, it is difficult to say what share, if any, inflation had. It should never be allowed to interfere with the means used for warming the person."

CONCLUSIVE PROOF FOR THE HEAT METHOD.

Are not the coincident views of Dr. Taylor, and those of the author of this book very striking and remarkable? Does it not seem almost certain that one has plagiarized? As Dr. Lambert successfully applied the "heat method" as early as 1843, he cannot be accused. But as the book from which the above quotations were taken was issued in 1845, Dr. Taylor is certainly excused from having adopted "Dr. Lambert's theory" (as it has been wrongly named, since, if it was discovered by him, it has also—he was and is glad to find—been discovered and successfully used by numerous other persons before and since his use of it, showing that it is "Nature's theory," or rather method.) Dr. Lambert assures the reader that, until a few days ago, he had never read a word nor an extract from the cited volume, to which he is more than glad that his attention has been called. He obtained his ideas as Dr. Taylor did his, from Nature and from facts, coincident with his, though world-wide apart from them. Since the conclusions, so nearly alike, were

reached independently, it is impossible that they should not be reliable, and it seems to be impossible that any mind can resist this argument.

AUTHORITY FOR ARTIFICIAL RESPIRATION.

We must not, however, overlook Prof. Van der Weyde's opinion in favor of artificial respiration. He says that, in his experiments upon animals having their animation suspended, "a few puffs of air into their lungs always at once excited the action of the heart, and of natural respiration." He thinks that a box inclosing the Body from the neck down and with means for exhausting and returning its contained air, should be made and tried, compelling the inhaling (in hauling) and expulsion (ex-press-ion) of air into and out of the lungs more completely and naturally than any other artificial way can do. This would also tend to draw the blood from the head, in which often there is congestion. If the air is hot, it would also very effectively tend to warm the internal parts of the body. Let the idea be materialized and tried.

Dr. John William Draper, one of the most eminent of the world's chemists, also thinks highly of artificial respiration. He says :

"In restoration from drowning the success turns wholly upon the re-establishment of the arterialization of the blood ; that accomplished, circulation is restored. I believe that in many cases in which now there are failures, there would be success, if instead of atmospheric air, pure oxygen, or protoxide of nitrogen were used in artificial respiration."

Dr. Draper is the best man in the world to try the experiment, and, if successful, to bring it effectively before the public.

Dr. B. W. Richardson also favors artificial respiration, and his is a very weighty opinion. See article cited :

"The action of nitrous oxide gas upon a rabbit was shown to a large audience. The animal was removed a little too

late; it had ceased to breathe, and was to all appearance dead. By the use of a double-acting bellows respiration was restored. In about six minutes the animal leaped into life [animation] as if it had been asleep, exciting, even in that cultivated [medically] audience, great surprise."

"An intoxicated man fell into the water on account of the ice breaking. He was taken out apparently dead, but under artificial respiration, carried out by my friend, Dr. Belgrave, he was restored to consciousness and lived several hours."

Dr. Taylor also remarks:

"Many rescued from the water alive have, in spite of the usual restoratives, after some minutes or hours, died; exhaustion being induced by struggles, or by the cold medium, or by both." *

I am inclined to think that in these cases sufficient care was not taken to warm the body thoroughly. All will remember how difficult it has been for them to become warmed through when thoroughly chilled. How much more difficult it must be in case of suffocation? This is too often forgotten.

The Body will need warming for a very considerable time after animation occurs, or after being taken from the water, though not drowned. The great length of time required for restoration in some cases is doubtless owing to the time required for heat to reach the centres; but, as in the suspensions of animation by drugs in the cases given, much time elapsed before the animal was ready to recover,

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* I must not fail to interject one testimony of Dr. Taylor: "Many persons fall into the water and appear to be drowned whose death [whose cause of death] have actually preceded their submersion; they died from fright, or terror [causing syncope], or from their heads striking hard bodies, or even the water, or from receiving a shock at the pit of the stomach, or in the region of the heart. In Paris, of one hundred who fell into the water, deaths were caused by asphyxia [suffocation], pure, 25; asphyxia and syncope, or cerebral congestion, 62.5; syncope, apoplexy, or concussion, 12.5." When, therefore, we find a person apparently drowned, we must inquire what the real cause of the appearance is.

so it may be in some cases of suffocation, that time is an element or factor in the recovery.

LET SOMETHING BE DONE.

While, therefore, I am of the opinion at present that the application of heat to the suffocated is the only, and it is certainly the first, thing necessary to be done, I think there is no harm in discussing all sides of this question, nor in trying any experiment that any authoritative person suggests. Results cannot be made worse than they are, nor can the crassic ignorance be more absurd than it is now. A friend, a doctor, the other day, said that a patient told him that when his mother died they put all the ice that they could about her for two days, yet could not make her cold, and were obliged to bury her while yet warm. What an astounding fact !

A gentleman whom I have known as a reliable man for years, told me that a lady living near him a few years ago, died in the evening, as her doctor and her family thought. She was laid out in the parlor, the upper sashes a little lowered, and the family retired. Waking in the morning they heard a noise in the parlor, and hurrying in, found their mother sitting up and asking why she had been left there alone and clothed so thinly in the chill night air. She is alive and well to-day. If she had been subjected to the ice treatment, where or when would she have come to consciousness ?

Dr. Richardson's experiments (article cited) tend to prove that ice or cold sometimes preserves the Tissues, as he thinks, in a condition for restoration, that is non-pectous, but cold certainly prevents self-restoration.

A lawyer recited to me a case that he read some twelve years ago in the *London Lancet.* A person taken from the water a considerable time after being drowned, was, for some

reason not mentioned, laid upon a "dung-heap" near by. Fortunately it was actively decomposing, and its kindly heat, and that of the sun restored the man, to the astonishment of the bystanders who had gathered to bury him. What would have been his chance if he had been put upon ice? It might have preserved his restorability, and if heat cannot be had for a long time, and the ice can be had at once, it may be useful; it obviously destroys all chance of self-restoration, the cases of which are too numerous to have its probability disregarded.

But all ways of restoration and preservation must be studied and tried until this most important of all subjects is fully investigated, and all the facts obtained, so that complete and reliable directions may be given for all restorable cases.

(There is some probability that this will be done, now that it is an object to ship live animals in the best condition to England and elsewhere.)

GOOD RESULTS TO COME.

When this good time comes, ignorant coroners, selected for political reasons, undertakers desirous of double profit, and doctors who do not know the true signs of death, will not any more be allowed to decide life and death questions.

It is getting altogether too common to have a villain steal his way into a house, and by chloroform stifle, or by a warm wet cloth applied over the nose and mouth smother, in one moment's time, those whom he wishes to rob, and who when found are called dead; and consequently, no efforts are made to resuscitate them.

Prof. Van der Weyde very properly and correctly testified in a case, in which the autopsy even did not show a single positive indication of death, but did give strong negative indications of life, the blood being fluid, etc. The very knife should have made a pause upon that revelation alone.

To many these words may, doubtless will, seem sensational ; but to one who has (as the writer, under a stroke of lightning has) been incapable of motion yet able to perceive distinctly that those around accepted his compulsory quietude as a sure sign of death, and of course expecting his speedy burial, the idea of any person being buried or cut up alive is the most horrible that can be imagined.

It is all very well to turn on the heel, and say that the person is dead. It saves trouble and also avoids the betrayal of ignorance of how to conduct a restoration. But is it not the duty of an intelligent man, and of one who ought to be intelligent, to make every effort, and to exhaust every resource, even against hope ? Reader, what you would that others should do for you do you the same for them.

Dr. J. P. Garrish, an eminent physician of this city, which has the honor of his nativity, in a very interesting, useful, and well-argued paper upon drowning, read before the Farmer's Club, says :

" When the deaths from drowning in this city for one year amount to 177, and to 134 for the eight months following, and in the whole United States to thousands yearly, will not each one of us endeavor to instruct ourselves and all of our citizens in the proper means for restoration ? I deem it the duty of every citizen to instruct himself in some measure in regard to what should be done in emergencies like those mentioned. It is the bounden duty of every good citizen to learn the most approved methods to be put in practice. We should under all circumstances do all in our power to save life, whether the person be high or low. I have heard it said by an idle spectator, ' perhaps it is no matter if he does die, he may be of no use in the world.' I hope and trust that I shall always believe that there is some good in every man, something worth saving."

Those are the noble and practical sentiments which should actuate every man, certainly every one who has had the privilege of being educated in that professional knowledge the object of which is to promote the welfare of man.

RULES FOR RESTORATION.

Having thus demonstrated much beyond what was necessary, except for the importance of the subject, and beyond the possibility of cavil by the most captious and carping disposition, that in plants and brutes, and not less in man, life can be and has been suspended for long periods, yet was perfectly restored by self-animation, or by the persevering aid of others, it remains to point out the ways in which our efforts should be directed for the accomplishment of restoration.

CONDITIONS.

It is proper to warn the person who uses his efforts in the attempt to save those who are suffocated, that it is often quite impossible, with our present knowledge, to discern between simple drowning, and drowning complicated in various ways that will prevent recovery. The inheritance of great vitality, and the possession of excellent health, promoted by excellent habits, is as favorable as the inheritance of an inferior constitution, being affected by lurking disease, having bad habits, or receiving a blow when falling into the water, is unfavorable. A strong constitution tends to prevent fright, so does skill in swimming, (which every one should learn), giving courage when falling into the water, as much as a weak constitution and inability to swim induces "palsying fright." If a person has a head narrow through the base, in the region near the ears, and a small flat chest, especially if one side of his head and trunk is decidedly smaller than the other, appearing as if it had been at best half paralyzed, the case is not very promising. Persons who have fatal diseases either incipient or which have progressed,

are as likely to fall into the water as the hearty, perhaps more so, and will be certainly more apt to drown. Such will not only be more apt to be frightened, but the fright will be much more likely to be fatal. Yet again, in many such cases, restoration will only require more time. The syncope of mere fright will not usually be fatal if time enough is used in restoration. But as, in the absence of evident destructive injury, it is impossible to say, before the signs of death appear, who is and who is not restorable, the drowned must always have the "benefit of the doubt," and persevering efforts must be made for his restoration.

THE THREE RULES.

The first rule is to produce and to maintain proper temperatures in the body; if a part is too warm, cool it; if too cool, warm it.

The second rule is to try, after producing proper temperatures, not before, to induce circulation and the heart's action.

The third rule is to try and excite breathing.

These *three rules* include all that can be done toward restoring suspended animation, no matter from what cause or in what way it has been brought about.

How shall these three things be done, is the sole question.

It has evidently been ordained in the structure of man, that as all sorts and conditions of men are subject, beyond their control, to contingencies and their consequences, producing suspended animation, so all sorts and conditions of men should be, and are, able to understand and to control the means necessary for the restoration of animation. Indeed, ingenuity, tact, and common sense are, as a rule, much more important in these cases than professional knowledge. Only occasionally will it be essential, yet it should

always be had when possible. But when that which is supposed to be professional knowledge and skill proves to be inexcusable ignorance, its absence is preferable.

RULE I.

How to Cool the Body.—If a part is too warm, cool it by applying heat and friction to other parts, and to itself apply cold air, water, ice, metal, or the spray of ether, or other evaporable fluid, aided by air in motion. The running of water over a part rapidly takes away its heat. Copper is the best conductor of heat, and if a thin strip of it (tinned) touches the part, and one or both ends of the metal are kept in contact with cold water or ice, or are sprayed with ether, or the like volatile liquid, the heat will be drawn away very rapidly and neatly.

To cool the whole body many in summer seek the streams, lakes, or sea ; but a cold tub, shower, or sponge bath at home, enjoyed for a suitable length of time, will also be serviceable in reducing its temperature.*

How to Heat the Body.—The ways of doing this are multiform. Dr. Taylor (page xv) specifies several. Usually the best way is to use the hot water bath.

A letter from a Doctor makes TWO GOOD SUGGESTIONS :

" * * * * * I have saved many infants by clearing out their throats and then immersing

* If salt water is thought to be advantageous, put a portion of salt into the bath. A rule as to how long the cold bath may be used is found in the action of the kidneys. As soon as that is hinted, stop the cold application, as the kidneys are reducing the water of the blood because the Body needs heat. If a person feels in the least chilly, let him leave the bath at once, and give himself a good rubbing ; do not rest, but at once get warmed in some way. One way of cooling the Body is to wash the hands, arms, face, and neck in ice water. Two quarts applied to the skin until it is cool and the water warm, will do no harm unless a chill is felt, while no one would be so rash as to drink two quarts of ice water. There are Nervous Centres near the stomach which are liable to be chilled below their health, and even their life point, by too much coldness ; when the stomach is chilled there is, therefore, great danger to those Centres ; drink something hot at once.

their bodies in quite warm water. Once when I could not immediately remove the substance from the throat, and the infant, being put in the bath, seemed inclined to breathe, but could not, I ventured to cut, with my penknife, a slit into its trachea [windpipe] and to insert a small tube, and was gratified with a complete success. It breathed at once freely. I soon cleared its throat, closed the opening that I had made, and the parents were delighted with a long-desired child. It is living yet, a stalwart boy. Why would not a hot water tub-bath be good for warming the drowned ?"

A sensible Doctor that. Nothing can be better for the suffocated or breathless, whether young or old, than the use of a tub-bath as hot as the hand can continuously bear. Cover the trunk and limbs with water and let down into it the head until the water rises near to the mouth. The brain cools and is warmed more slowly than any other part, while to preserve or to produce its proper temperature is of prime importance. Any obstructive substance should be removed from the throat of an infant, or else its windpipe should be cut open in front, before the infant is placed in the warm bath. This use of heat will recall to Doctors a thousand similar experiences. Why has it not been equally applied to the restoration of adults ?

GOOD WAYS.

Next to this a vapor bath is best, then the hot air bath, unless radiated heat is plentiful, that is heat from an open fire, a stove, steam pipes, etc. An engine-room of a steamboat is usually an excellent place to heat a person. A set of steam pipes around a person would be one of the best methods of heating him quickly, since the heat could be easily regulated, while radiated heat seems to be more piercing than conducted heat, probably because a higher degree of it can be endured in that form. Of course, a proper arrangement of the pipes would not happen by any chance. A baker's oven, if not too hot, would be an excellent place.

A person might be placed quite near a fire, stove, or other hot focus; if he is turned now on this side, now on that, and the part away from the fire, etc., is covered to prevent loss of heat, to roast him thus so to speak, will often be a good way. The hot sun's rays can thus be used to great advantage. I believe that its chemical rays have also an effect. If hot water is plentiful, cloths, sheets, blankets, carpets, etc., can be wrapped about the person and kept saturated. If water cannot be had, those articles, dry and hot, may be, if possible, used. Linen is then the best material to use, since, among cloths, it is the best conductor of heat. They must be often reheated; there should be a double set, one heating while the other is applied. Fluids hot as the hand can bear, or a little hotter but not scalding, may be (two quarts) injected into the bowels, and half that into the stomach. An excellent plan at first is, to pour hot water into the nose and mouth until they are full, pouring out the water in a minute or two, by turning the face down sufficiently for the purpose. This also washes out the parts, if they contain anything. This is not to be done if the heart is beating, unless it is done very quickly, since it might interfere with incipient breathing. If any one looks at Figure *A*, of the section of the face, he will see that the back part of the cavity of the nose is very near to the base of the brain where the vital centres are. Hence hot fluids will, if poured into the nose and mouth, quickly warm those all-important centres. Hot bricks, or other hot solids, bags of hot sand, etc., may be put to the feet, hands, between the legs, in the arm-pits, along the sides of the chest, the neck and head, the person may be laid upon them, etc.

I have suggested many things in hopes that some may be useful, and because invention and ingenuity are not, under excitement, likely to do their best. I shall be thankful for any suggestion from any one.

Rule II.

The influence of rubbing, in order to excite the action of the heart and circulation generally, is well enough known. The hand is usually best for use, but it is sometimes advantageously covered with flannel hotter than its own temperature. It should be pressed forcibly as it is moving up the limbs, but not at all as it is moving down. It should be passed around the trunk from the middle line toward the back with pressure. The head should be rubbed with both hands, at least not across the middle line, and with pressure downward. If this course is adopted, it should be persevered in for a long time, or its use will surely not be satisfactory; since, if the blood is to be driven through its entire round, by pressure upon the blood-tubes in the skin (*vis a tergo*), much time will be required.

IMPORTANT QUESTION AND ANSWER.

Another Doctor asks: "Which is the quickest way to excite action in a person suffocated not more than from one to five minutes?" Open wide and shut the lids of both eyes at once, several times in rapid succession, letting the light, bright as possible, flash into the eyes for an instant; thrust a feather or a finger into the throat; tickle the nose with a feather, slap the person, throw water against his face, or do anything that usually makes a person catch his breath. Let nothing, however, delay the preparation and application of heat. Probably in so short a time after drowning, a hot, dry or wet cloth to each foot and hand will suffice. If a syringe is handy, inject a quart of water as hot as the hand will bear into the bowels through the *rectum;* if a stomach-pipe is convenient, inject a pint of the same water into the stomach through the mouth. Pour hot water into the nose and the mouth, as previously directed in Rule I.

The influence of electricity is uncertain, yet, as it can do

no harm, it should be faithfully tried until its influence is fully known. Magnetism, galvanism, etc., is the same thing practically. A shock can be had from the telegraph almost any where.

Rule III.

How to Excite Breathing.—By bringing the heat of the nervous centres up to the natural temperature, and by the various means suggested to excite the heart's action, of course the same nervous centres will be excited to induce breathing. Indeed, the expression "to excite the heart's action" should have been "to excite the action of the nervous centres," which naturally control the action of the heart and of the breathing apparatus, which action is, therefore only a secondary result of the primary action of the nervous centres. But, artificial respiration is, by many, thought to also stimulate the heart and lungs to action,* not

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* They think that the oxygen of the air, leaving it and entering the blood of the lungs, causes it to move on its courses back through their veins toward and into the systemic heart, some say acting upon it or upon the nervous cells among its muscular fibres, and causing it to contract; others say that the blood containing its fresh oxygen moves on through the heart into the systemic arteries, and so on until it visits the nervous centres and excites them to excite the heart and breathing-muscles to action. At the same time the carbonic acid gas, they say, leaving the blood in the lungs to pass out from the Body, draws the blood, from which it parts, into the lungs, which effect going back through the arteries to the right heart, extends its influence through it and the veins until finally it acts upon the blood that has come to the nervous centres, and which it draws along on the way back to the lungs. The carbonic acid gas in the lungs, they say, thus acts as a chemical suction-pump, while the oxygen acts as a force-pump to produce a circulation; while, again, the action of the nervous centres, and other tissues, act similarly upon the circulation of blood by taking substances from it, drawing it on, and by throwing substances into it, forcing it away from themselves. Some think that these various changes of the blood in the lungs and tissues are the chief forces that produce the circulation at all times, and in case of artificial respiration are equal to starting anew the circulation; yet, remember that, if the oxygen should reach the Nervous Centres, they could not act if they were not at their natural temperatures; but these persons say, that the oxygen freshly arriving finds effete substances previously thrown out by the centres, and combining with them in its scavenger capacity, it burns them, producing the required heat. Yet if this theory should be found to have a measure of truth in it, it is evident that if the Centres have been artificially

by any action upon or through the nervous centres directly, but by an effect that the air produces upon the blood in the lungs, which blood, having been acted upon by the air, they say, also acts upon the heart and excites it to action. Some of these persons think that the chemical actions of air upon the blood are the chief causes of circulation in the lungs at all times.

ARTIFICIAL RESPIRATION.

Whatever its importance may be, it is a duty to explain the process of artificial respiration. It differs from natural respiration, not in the ultimate object of causing air to pass into and out of the lungs, for the purpose of having oxygen enter and carbonic acid gas leave the blood in the lungs, but it differs in the mode in which that object is attempted. Naturally the muscles of the chest, induced by the nervous centres, alternately expand and contract the chest, as we every moment see, causing the breath to pass into, and, with the aid of their elastic tissue, out of the lungs. (This demonstrates that the nervous centres must work before one breath can be taken *naturally*,—good for the "Heat Method.") Naturally the air is sucked into the lungs, and by their elasticity (chiefly) pressed out.* By the

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warmed, they will be more ready to welcome the visiting oxygen. The heat method is, therefore, right under either theory, that is whether the action of the Nervous Centres or of the lungs is the primary cause of Circulation. It may also be said that there are several apparently unanswerable arguments against the latter theory, that the action of the air in the lungs causes a complete circulation of the blood.

* If we close the windpipe, and then contract the chest, we cause it to apply itself closely to the lungs, and to compress them, and of course the air within them; and when the windpipe is opened again the elastic air comes out with a greater force than could be given to it by the elastic tissue of the lungs alone. This elasticity is the only force that expels the air in ordinary breathing. (See Pl. 6 or 7.)

This force cannot equal 15 pounds pressure upon each square inch of surface in the lungs, if it did the pressure of the air, which is that weight, into the lungs could not overcome their elasticity, and they would not be expanded. Their elasticity in a healthy person is a force approaching 15 pounds

common artificial method, the air is forced into the lungs (or this is attempted), and the elasticity of the lungs and pressure upon the chest are relied upon to drive the air out.

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to the square inch of surface in the lungs, hence, that must be overcome by the force that drives the air into the lungs in artificial respiration. It must also overcome the reluctance of the chest to enlarge. This makes forcing the air into the lungs a very different affair from what the natural suction of air into the human lungs is; in this case, by its strong muscles, the chest is enlarged, thus taking away the external pressure from the lungs, and leaving nothing but their elasticity to be overcome by the weight of the air, which then distends the lungs easily.

When the chest is relaxed or contracted after expansion, the internal pressure of the air is balanced by the restored external pressure of the air upon the chest, and by it transmitted to the lungs, the elasticity of which alone, expels the air from the lungs.

The forces, then, which immediately cause air to pass into and out of the lungs, are (1) weight of the air, and (2) elasticity of the lungs; the walls of the chest, by (*a*) expanding, and (*b*) contracting, permit or compel these two forces to alternately force the air into and out of the lungs.

The elasticity of the walls of the chest have very much to do with the (*a*) expansion, and the (*b*) contraction of the chest.

When the chest is at its resting point, neither (*a*) expanded, nor (*b*) contracted, its elasticity (of its cartilages, etc.,) is not in force; but, as soon as the chest varies from this point either way, its elasticity (like that of a springy stick, when bent) resists, and must be overcome; but, it is then constantly ready to restore the chest to its resting point. When expanded above that point, its elasticity alone will restore or contract it to its medium point (as the elastic stick, when bent, is constantly ready to spring back to its natural position). If the chest is contracted below its resting point, its elasticity will also tend to restore it to that point.

These elasticities of the chest and of the lungs continue not only after apparent, but after real death. Both hinder and both aid in artificial respiration precisely as they do in natural respiration; and, for even partial success in artificial respiration, both must be advantageously used; indeed, how to do that is the chief practical point.

If the air is forced into the lungs naturally by its weight, it has to overcome only the elasticity of the lungs, which, being a less force than the weight of the air, is overcome by it, and the lungs are distended. In this case the resistance of the elasticity of the chest has been overcome by its muscles, and not by the forcing of the air into the lungs. But, in artificial respiration the force which distends the lungs, and overcomes their elasticity, must also overcome that of the elasticity of the chest, unless the chest is contracted below its medium point. In this case the elasticity of the chest tends to expand it back to that point. Now, it is doubtful whether any force could, without destructive injury to the lungs, force the air into them so as to expand the chest above its medium point, overcoming its elasticity, while there is no other way of overcoming it except by the box suggested.

What is now done, therefore, is to try to diminish the chest, in some way, below its medium point, and to allow the elasticity of the lungs to throw out from them a part of the air in them, and then to allow the elasticity of the

It is evident that if the air is forced into the lungs, it must distend the sides or the bottom of one chest or the other, or of both (right and left). To do this requires considerable force, more than can usually be brought to bear. If artificial respiration is attempted, the first act should be to suck, if possible, air out of the lungs. Unfortunately for this work, as a rule, the suffocated person expels all the air possible from his chest, and at the last act of breathing reduces the chest, or rather, unconsciously to him, the chest is reduced to the smallest possible size. The corresponding expulsion of air is the cause of his sinking.* This is as it

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chest to expand it up to its medium point, whereupon the weight of the air will cause it to enter the lungs, overcome their elasticity and distend them, with equal step as the chest expands.

It is now evident that any intelligent effort for securing artificial respiration must be made alternately, first to diminish the size of the chest below its rest point, and, second, to allow it, by virtue of its elasticity, to expand again up to its rest point.

Some persons breathe wholly, others mostly, by expanding the chest above its rest point, to which it comes back, but below which it does not contract. Others, again, breathe by contracting the chest below its rest point, to which it is restored. In each of these cases the elasticity of the chest acts only one way, in one case diminishing, in the other enlarging the chest. In the latter case, namely, when a person naturally breathes by contracting his chest below but never by expanding it above its rest point, attempts at artificial respiration will be more successful; in the former case, such attempts will usually prove fruitless. Only a very little air could, at best, by any possibility be made to enter the lungs in one case, while in the other there could be an approach toward as full an inhalation as was natural to the person. Persons in whom the expansion and the contraction of the chest are both above and below the rest point, can receive only about half a breath of air, since artificial respiration, by any means now used, can control only the action of the chest below its rest point.

The point in artificial respiration is, therefore, to diminish the size of the chest as much as possible. How to do this may be learned by experiments upon animated persons. The best way that I have found, by experiment upon the animate and inanimate, or of which I have read, is shown in the text.

* It is evident from this that a person will not "sink," or "go down," but once, and then to stay; not because water enters the lungs, but because most of the air has passed out of them. The idea that a person rises three times to the surface, has not the least foundation in truth. A person may rise above and sink below the surface several times in his efforts to avoid drowning. If he happens to take a full breath just as the opening into his windpipe closes, and the air is not forced out as he becomes unconscious, he will float. He will also float if charged with alcohol, as seen in a recent case.

should be, if it is a provision for restoration by the natural action of the Nervous Centres, the first effort of which, upon the respiratory apparatus, will be to gasp, that is, to draw in air by suddenly enlarging the chest. They can do this the better if the chest has been reduced to its smallest size, since its elasticity alone will then almost, or quite, do what is wanted. All that the centres will then have to do, will be, when every thing is ready, to cause the windpipe to be drawn down, opening it into the throat, and giving a free passage to the air. Is not, then, the extreme diminution of the chest, in drowning, an admirable provision for a speedy recovery ?

METHOD OF ARTIFICIAL RESPIRATION.

A Doctor writes :

"Please give me the best method for one alone to use in producing artificial respiration, with no special means at hand, or cannot one do it ?"

I will describe the "best method," the simplest in any case. The doctor can judge for himself whether "one" can "do it." Will it not depend much upon who the one is, how strong, ingenious, skilled, etc. ; upon who the drowned person is, how heavy, how "built," etc. ? My friend, Dr. G., can certainly, in most cases, "do it," being strong in body as well as skilled in surgery.*

Two things are essential to artificial respiration :

(1) A free passage for air into and out of the lungs.

(2) To make the air pass back and forth through that free passage.

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* Theoretically and pictorially, nothing is easier than to indicate how to handle the body so as to induce artificial respiration, and in a sample case of a young, tall, light weight, elastic person, with three or four inches expansion of his chest when breathing, the directions can be easily followed ; but, in cases in which the person is heavy, short, with the neck and throat encumbered with fat, inelastic, having an expansion of chest of only one to two inches, the task is by no means easy. It is in fact very difficult to produce any practically valuable results in any case. Hence, the necessity of the box mentioned if effective work of this kind is essential.

There are two ways for securing a free passage : (*a*) by cutting a long slit in the windpipe, just below the larynx, and securing the opening there ; (*b*) by securing the natural opening from the windpipe into the throat. To understand

Fig. *A*.

Fig. *A* is an outline plan of Fig. *B*, a little more idealized, in the hopes of making the relations of the localities in the throat familiar to the reader. A, is the passage into the cavity 1, of the nose ; 2, is the floor of the nose and roof of the mouth, the hard palate ; 3, veil, or soft palate ; 4, hanging point in the throat, or uvula ; 5, cavity of the mouth ; B, lips ; 6, tongue ; 7, back part of it ; 9, tip of the windpipe ; *a*, epiglottis, or cover of glottis ; *b*, opening into the larynx, *c*, which opens into *e*, the trachea, or windpipe ; *d*, Adam's-apple ; *f*, trachea, or windpipe proper ; *h*, food and water pipe, or æsophagus ; *z*, *z*, spinal column ; *x*, *x*, *x*, spinal canal, the upper *x* being the locality of the vital centres, back of the nose, and therefore easily warmed by hot water poured into the nostrils.

either way, study the three Figs., *A*, *B*, *C*, which represent perpendicular sections of the facium and throat.

Fig. *B*.

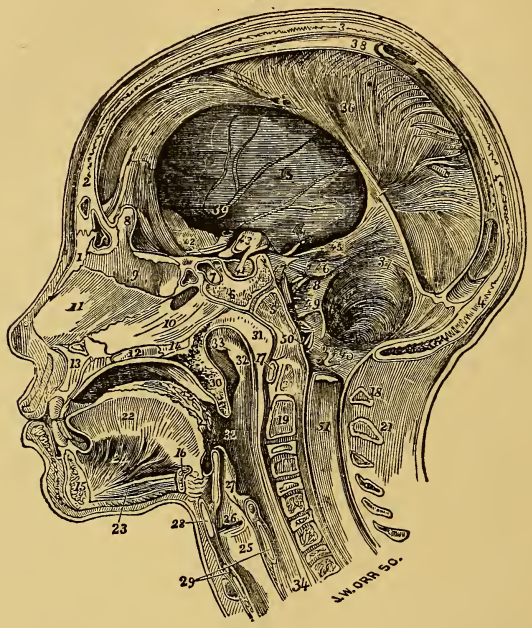
Fig. *B*, in the original, is one of the most beautiful representations which can be found in the whole range of anatomy. The relations of the parts that it represents are so important that it is well worth the repeated study of the intelligent reader. The description of *A* and of *C* will suffice to explain *B* for all practical purposes here.

Fig. *C* represents a section of the head and neck upon the middle line. 2, 3, 4, are the skull and its three tables. The membrane covering the Cranium can be distinctly seen below 4, as it extends down joining the lining at the edge of the hole in the base of the skull, from which it extends up, lining the cranium, and down, lining the spinal canal of the spinal column or back bone, within which, 51, the spinal cord, cut off above, is seen, not quite filling the canal. On the opposite side of the canal its lining can again be traced and followed up within the Cranium till it reaches around to the commencing point.

Where the lining of the Cranium reaches its central line, near where the section is made, it leaves the cranium and extends down quite to the

(*a*) To cut an opening into the windpipe, press the skin down upon each side of the windpipe, holding it firmly be-

Fig. *C.*



bottom of the front part, and two thirds down the back part, and down the centre to the arched line shown, under which connections between the right and left brains stretch across.

Thus the Cranium is divided into its right and left cavity. Into the right one the eye looks and sees 39 and 35, on the inner surface of the right wall of the Cranium. From the form of the partition, 36, it is called the Falx or sickle. From its lower edge it extends back again up to the cranium, joining it near where it left it, but, spreading a little, it leaves a triangular space, 38, that properly lined becomes a vein, called a sinus.

From a point against 4 the lining also extends forward, arching upward, and forms a shelf called Tentorium, to the upper surface of which the back part of the Falx is attached. The Tentorium supports the back part of each large Brain, and covers and protects from pressure the small Brains. The Falx supports the upper brain when the head rests upon either side. The Cranium is thus divided into three cavities, neither completely closed, the two upper ones corresponding to and containing the right and left cerebri, and the lower one the cerebellum.

tween the thumb and finger, and cut through the skin and into the windpipe a long slit, from just below the enlargement (*d*, Fig. *A*) named the larynx, or Adam's-apple, down to the level of the top of the breast-bone, or so long an opening as is needed. There is no danger of its being too large. It will be small enough at best for practical purposes.

The cutting into the windpipe will call for about the same force as would be necessary for cutting the nails.

To preserve the opening free, wedge its sides apart, or insert a tube. One can be made by simply rolling stiff paper (letter or the like) around the little finger, a pencil or the like, several times. Obstruct the passage as little as possible, and fasten the wedge or the tube so that it cannot slip into the windpipe.

Now mark the simple fact, that there is no more danger in cutting open the windpipe than there is in cutting the nails, and do the former with the same promptness and coolness with which the latter would be done, if it would save a person's life.

Remember that there are neither blood-tubes, nor nerves, of any account, near the perpendicular, central surface line of the body, below which the windpipe is situated.

Indeed, the windpipe seems to have been located just in the right place for being easily and safely cut open, even by a bungler, upon many occasions when necessary for saving life.

If the person's neck is short, thick, and fat, so that the windpipe cannot readily be felt, the opening of it will not be so easy. Sometimes it will be necessary to open it by cutting across it, until it is nearly or quite cut through. No harm can result, but it is not as handy an opening through which to work.

I think and advise that this free passage should be provided at once, in all cases of suffocation for so long a time that the

*heart has stopped its beating. It is the only sure way of securing an opening.**

(*b*) The mode of securing the opening from the windpipe into the throat, would appear to be the most natural, as that is the natural passage. But, there are two difficulties: first, the keeping of the passage open; second, preventing substances—thrown up from the stomach by its own action, or by pressure applied externally—from entering the windpipe. The Argus which ordinarily watches this opening, is spell bound, and the great difficulty thus experienced testifies to the very valuable service usually rendered.

This difficulty is presented by each of the figures *A*, *B*, *C*, in which the windpipe is represented in what may be considered its natural or normal position, its opening, *b*, Fig. *A*, being free into the throat, and ready to receive any thing. But when animate, the instant any liquid or solid substance attempts to pass into it, the windpipe is raised tightly against the epiglottis, *a*, and the tongue being held firmly against the roof of the mouth, the opening is firmly closed, also against air. This is the position of those parts when a person drowns.

What is to be done to make this passage, *b*, free again?

It will be readily understood that, if the tongue is drawn out of the mouth, it will tend to drag up the epiglottis *a*, and to open *b*.

But, at the same time, the whole larynx *f*, *d*, *h*, tends to move up and keep *b* closed. When the tongue is drawn out, the larynx must, therefore, be held or pressed down at *d*.

To draw out the tongue is difficult, and to hold it drawn out is very tedious. A doctor writes to me, that, to secure its extension at one time he "thrust a skewer through it,

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*So many hundreds of lives might be yearly saved by this operation, that all children should be taught its simple propriety, so that, when they become parents, they may not object to its being done, as is now usually the case.

which worked well;" he certainly se-skewered it. That way was rather rough, but those who understand his difficulty will excuse him. To seize the tongue and hold it securely, cover the thumb and finger with any piece of cloth; if it comes out reluctantly, pass the finger over the base of it, and thus aid in drawing it forward, or in holding it while a fresh hold of it is obtained. It is so conical and slippery (not figuratively) that it is difficult to tie anything around it so tightly that it will hold, but success is most likely to follow the use of a strip of cotton cloth, a couple of inches wide, folded twice, so as to be half an inch wide and strong. It is evident that if the tongue is allowed to recede into the mouth, the opening *b* will be almost or quite sure to be closed. The tongue must then be kept drawn out, if the free passage of *b* is desired.*

If this opening is depended upon, the operator should make sure of it by ascertaining with his finger whether or not it is open. This is not exactly easy, yet he must not go on with any uncertainty about this point. If he can insert and keep a thin wedge in the glottis *b*, so as to only partially fill its space, he need have no farther trouble. But this is merely a suggestion, and probably impracticable in most instances.

Having in one way or the other secured a free passage (the only proper one is by cutting a slit) for air into the lungs, proceed to induce the movement of the air.

Support the head, shoulders, and hips of the drowned, from four to eight inches above the level of his back, so that it curves down between the shoulder and hip supports.

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*The relation of the parts mentioned can be better appreciated by drawing out the tongue of a fowl, its throat being built in such a manner that the opening *b* can be seen, and although there are differences in the structure of these parts in men and in birds, the general idea is the same in both. By a laryngoscope (an arrangement of little mirrors), any person can look into the throat of another and see its parts, and their relations.

The head should not be as high as the shoulders by an inch, if the air is to pass in through the throat; it should be an inch higher than the shoulders, if the air enters otherwise. Pass under his back, half way between the supports, a band, like a pair of suspenders, a rope, a narrow (two, three, or four inches wide) board, or a stick, any thing strong enough, and taking hold of the two ends, raise the central part of the trunk until the back curves up, or until the shoulders or hips are about to be lifted from their supports; then lower the back to its former position. Do this slowly, as he is raised, but let him down (almost drop) quicker, and repeat from ten to twenty times per minute.

It will be evident, that, when the central part of the Trunk is drawn up, the chest is diminished in every direction, bringing into antagonizing action the elasticity of the chest, which, as the chest descends, will expand it, and tend to draw in air. Theoretically this is just so, but practically this process does not produce all the inhaling that would, by many, be expected. Since many are as stiff-backed when drowned as they probably were stiff-willed when they were animate. But this is the best way, for effect as well as for simplicity, that I have ever seen tried or described.

SIMPLE DIRECTIONS FOR MANIPULATING THE SUFFOCATED.

THE DROWNED.

(See Dr. Taylor's Directions, page xv.)

First—When he is taken out of the water turn his face down for a moment only, to allow any water in his nose or throat to run out; then, place him upon his back, out of cur-

rents of air, with his head very slightly raised. Do not roll him upon a barrel, nor do anything else to "get the water out of his lungs," since there is none in them; nor out of his stomach, since what he has swallowed will do no harm.

Second—Quickly determine whether he must be carried to the heat, or the heat brought to, or produced near, him. If he must be carried, take him gently, quickly, and as nearly as possible in the above posture to the designated place. If he have been drowned only for a few minutes, do as directed on page xxvi.

Third—If there must be delay in applying heat, and dry protectives can be had, take off his wet clothes, wipe him dry, and wrap dry articles about him to prevent loss of heat, covering the head particularly. The warm under clothing of bystanders can be contributed. Several thicknesses of almost any thing attainable is better than one.

Fourth—As soon as heat is at hand apply it as ingenuity and circumstances suggest to be the most likely to warm the body quickly and thoroughly. When this is accomplished, theory and fact agree in assuring us that, if life persists, the heart will begin to beat, happily soon followed by breathing; true, very feebly and infrequently at first, but growing stronger and faster until it becomes natural, when consciousness will return. If the heart gives one beat, or the lungs one gasp, no more need be done; keep the person warm and he will soon be "all right."

Fifth—Be sure that the windpipe is open before the breathing apparatus is ready to gasp. This free passage for the lungs is secured either by drawing the tongue forward, or by cutting an opening into the windpipe through the skin covering it at the front of the neck. The tongue can be firmly seized and held by covering the fingers with cloth. If the heart has stopped beating, and what is suggested under the second head does not succeed, it is better to open the

windpipe at once, by cutting a slit into it. If that is not expedient, try to open the windpipe into the throat as directed upon page xxxiv.

Sixth—When the skin has become hot, no harm can arise from rubbing the body with the hands (are the best), or with warm cloths, for the best way see page xxvi.

Seventh—When the body is quite warm, it will do no harm to try to produce artificial respiration, if the air in the room is hot. The taking in of cold air, I should fear, would retard the recovery. Yet some think that cool air is preferable, because it contains more oxygen, in a given volume, and will act more powerfully upon the blood.

Eighth—"Don't give up the ship," were the words of the brave Lawrence. In this case, the last direction is: Don't give up the hope of success until the appearance of the true signs of death indicate the final discouragement. Let not one hour, nor two, nor four times two, discourage effort; so far, at least, as keeping up the warmth of the body is concerned. After the body is once heated, this will not be difficult in most cases. From time to time, if it is thought advisible, other means may be repeated.

CHOKING (AND THROTTLING).

Two conditions have the name of choking, because alike in their results.

If one person seize another by the throat, pressing the larynx *d*, Fig. *A*, up and back, it is evident that the opening *b*, from the throat into the windpipe, will be closed, and in one short minute, upon the average, the person will be suffocated.

Sometimes the fingers may compress the veins in the neck, causing congestion of the blood-tubes about the brain.*

* The box suggested by Prof. Van der Weyde, would be particularly useful in this and other cases of brainial congestion.

A fright may induce a still worse complication, or the effects of blows of even a fatal character may be associated with those of simple suffocation, or the person may have been seriously diseased. If none of these complications exist, the course recommended for restoration from drowning ought to be speedily successful.

Suffocation produced by external pressure upon the throat should have a distinct name, as each of the other forms have, with surprising completeness. Let the name Throttling be applied to this form.

The other mode of choking, the only one properly thus named, is caused, as its meaning signifies, by food detained in the throat. It is most likely to occur when a person tries to swallow a long strip of meat. *

A, *B*, or *C*, shows that a not very long piece of meat will reach from above the opening *b*, down into the food pipe *h*. When it has passed a little way down, the nerves commencing there, excite the nervous centres to excite the muscular ring fibres at the upper part of *h* to contract, and press the food down. But if any part of the food has not passed below those fibres they will grip it fast. If the food extends also up to the opening *b*, already closed, it will also remain closed. The food must be drawn up or thrust down. Remember that there is but a minute, upon an average, to work in, ere the person will be suffocated. Let him, aware of the danger, instantly try to remove the offending substance by short, sudden, forcible coughs outward, if possible, without drawing in any air. (This is so often useful that young children should be taught to do it, and frequently exercised in doing it.) If that fail, let him thrust his fingers far down into his throat, and withdraw the food; if he can-

* In three instances narrated to the writer, tripe has caused choking, which unnecessarily terminated in death, on account of the ignorance of the bystanders.

not do that let him push it down with his finger, the handle of a small fork or knife, a pencil, or whatever the circumstances suggest. He cannot speak and must call attention in other ways. By-standers seeing a person in this trouble must go to his aid uninvited, and quickly do for him precisely what he has been counseled to do for himself.

If he find that he cannot remove the substance, he must, before he begins to become unconscious, cut an opening into his windpipe (see page xxxii), and from that instant he is safe. If he is becoming, or is, unconscious, let some one else cut open the windpipe at once, and if he does not instantly breathe, give him a smart slap upon the shoulders, or dash water in his face, and he will be all right in a few minutes. (See also what to do on page xxvi.)

If he is quite suffocated, and his heart has already stopped beating, proceed as in drowning. When he breathes again, the offending food may be removed. If in any way the person can be made to vomit, the throat will be cleared. Kneading the region over the stomach will often press its contents up, and dislodge any thing detained in the food passage (see page xxxvi).

STRANGLING.

This name is applied to several conditions. Hanging, seizing a person by the throat, etc. Properly, this word signifies the effect of something entering the windpipe.

When this occurs, let the person (1) cough as directed under choking. If this does not succeed, let him or another (2) reach down into his throat, and ascertain, if possible, if the substance has wholly entered the windpipe. If it has not, pull it out if possible. If that cannot be done, (3) at once cut open the windpipe (see page xxxiv); (4) if the substance is above the opening, draw it out or push it up into the throat; (5) if below the opening, cough as before directed, if possible; and if the substance rises to the opening,

catch it; if it does not, (6) hang down the head, neck, and shoulders as from a lap, chair-seat, table-top, or bed, and slap the shoulders, perchance the substance will slide down; (7) if it does not, reach for it with any convenient means, (a wire bent near the point, etc.), and draw it down. A knitting-needle heated red hot and cooled in the air, and bent near one end, is a good instrument, if the person has already become unconscious and can wait. As soon as the substance is in any way brought above the opening, hold it and let the person breathe if he will, or restore him if he cannot breathe; and remove the substance at leisure.

If the strangled person is suffocated, and the heart beats no longer, the first thing is to produce a free passage for the air into the lungs, and there is but one way to do it in this case (see page xxxiv). *

HANGING (THROTTLING),

properly speaking, is one form of throttling. It is often named strangling and choking; but there is nothing in the throat, nor in the windpipe; therefore, neither name is properly applicable.

In suicidal hanging there may be also the complication produced by pressure upon the blood-vessels of the neck, causing congestion of the brain (see foot-note page xl). The person should be taken down at once, and the process for restoration from drowning pursued.

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* Many a man in his ignorance thinks he can commit suicide by cutting his windpipe, but no one ever succeeded. "Well, Sam," said the doctor called to the first case I ever saw, "you could not breathe easy enough to suit you, hey! Well, you see that cutting your windpipe does not cut your breath. You have got a good deal to learn yet, Sam, before you die, and you had better live to learn it. Now I will fix this up for you so that you can go to work in a day or two, but if you do anything of the kind again, remember I won't come near you." Sam tried to answer, but the doctor spread the opening, and of course there was no voice. "I have got you where you can't talk back, Sam, and you just keep quiet," said the doctor. Sam did not reply; "the first time in his life," his wife said; showing why Sam cut his throat.

In public executions the intent is, apparently, to kill the person by a shock or concussion of the brain (by letting him fall, or by jerking him up), and then to hang him in nominal conformity with his sentence. The neck is seldom broken, and often the shock is not so decided as to put hope of restoration aside. If the person is merely choked when the "legal half hour" is passed, and the verdict of death has been declared, he can sometimes be restored, not on account of sympathy, but for the sake of science. One such case, at least, is personally known to the writer. The effects of an electric shock unexpectedly began a restoration which soon became complete.

SMOTHERING

is usually applied to that form of suffocation produced by preventing the air from entering the mouth or the nose. It may be produced in various ways. In case of crowds, falling buildings, caving earth, etc., the pressure upon the chest prevents its expansion, and no air enters the air passages. The mouth and nose may be closed by the hand; but the most fearful way is, to lay a wet cloth, at very near the temperature of the face, over the mouth and nose of a sleeping person; unless unusually sensitive and easily wakened, he will not be disturbed, and in one minute, unaided, is past awakening.

A gentleman asks:

"Is being buried under caving earth any more dangerous than being buried under water? Would not the conditions and treatment be the same?"

The expression is good, suggesting that neither burial is dangerous if a person has proper care toward his restoration. With this proviso there is no danger from any form of suffocation.

STIFLING

is a mode of suffocation produced by inhaling smoky or poisonous gases. Sometimes poisoning should be the name used. In most of these cases artificial respiration should be earnestly attempted, in order to clear the lungs of any remaining poisonous gas. Antidote gases should some times be introduced, if possible, into the lungs.

One important fact should be considered, namely, the length of time which Dr. Richardson says passed before certain poisons, or their effects, were dissipated from animals, and restoration was in order, self-instituted, and completed, in several instances which he gives (see page viii).

We often see the effects of the poison, alcohol, wear away after hours, the circulation continuing. But, as it evaporates through a thick wooden barrel, why, if the circulation has stopped, may it not pass away from the brains of a man who poisons himself with it, as the Scheele's acid did, in case of the cat apparently killed by it (see page viii) ?

FREEZING, COLD.

The idea of restoring thoroughly frozen persons is rather prophetic, than a fact of the past or of the present. Yet the following extract bears the intrinsic indications of credibility :

(*From the Joplin* (*Mo.*) *Daily Herald.*)

From a lady who arrived at the St. James Hotel, Saturday, from the central portion of Arkansas, we learn the particulars of an affair which possesses many features of interest, and to the medical profession in particular. The lady left her home at the beginning of the present cold snap, with the intention of coming to Joplin, and there being no other conveyance, was compelled to make the entire trip by stage. The only passenger in the stage with her was a man very thinly clad. While crossing the Boston Mountains he complained very much of the cold ; and, in fact, the weather was remarkably cold, even for the top of those mountains. After a while he apparently fell asleep. Arriving at the station on the north side of the moun-

tains, the driver attempted to awaken the passenger, but to his horror, found him frozen stiff, and apparently dead. He was taken out of the hack and placed in a room, which was rather cold, but not as low as the freezing point by several degrees. The lady remained at the station until the next day, and just as she was preparing to resume her journey, was surprised to learn that signs of life had been detected in the supposed dead man, who was to have been buried that forenoon. True enough, signs of life were plainly to be observed, and by lively rubbing with flannels saturated with whiskey for about an hour, he was able to speak. When the lady left, he was fast recovering from his stupor, and she had no doubt by this time he has fully recovered. Had he continued in that condition three hours longer, he would doubtless have been buried, as all thought he was dead. Being placed in a room of just the right temperature, no doubt assisted his recovery.

In our boy-hood we read in our school-books quite as incredible stories of the restorations made by the Monks and the Saint Bernard dogs, with probably more of truth in them than we then supposed. Science certainly knows no reason why those stories, or the above extract, should not be true.

The *St. Louis Republican* vouches for the truth of its statement, that a young dog of a gentleman of that city, being left out of doors one cold night last winter, was frozen stiff. His young son, not knowing any better, insisted upon taking the puppy in and warming him by the fire ; when the creature was thus heated thoroughly, it was fully restored to animation.

See extracts from Dr. B. W. Richardson, in several lectures and essays cited, pages 31, 32.

But this judicious and judicial writer, in *Nature*, article cited, also says :

There seems to be in cold-blooded animals no recognizable limit of time after which they cannot be restored. If in thawing them, the utmost care be not taken to thaw them gradually, and at a temperature always below the natural temperature of

the animal, its fluids will pass from the frozen to the pectous state so rapidly, that death will be pronounced without any intermediate animate stage. In warm-blooded animals it is extremely difficult to restore animation after suspension of animation by cold, owing to the fact that in their more complex and differently shielded organs *it is next to impossible to thaw equally and simultaneously all the fluids.*

But, is the difficulty which he suggests insurmountable? True, I have more a hope than a faith that the future will realize the desires of scientific men in regard to restoring the frozen man. Let us, however, remember the words of Dr. B. W. Richardson, in closing his article (see page vii), and if a case offers itself, let us try to produce a restoration. If we do not succeed let us say that the default is in us rather than in the impossibility of accomplishing the work. Otherwise the successful future may jeer at us.*

TRANCE.

Having had no practical experience in this form of suspended animation, I call attention to it only to suggest that the cases of trance demonstrate how long suspended animation may continue without the approach of death. It is quite evident that such persons should be kept warm until the certain signs of death appear, nor will it be amiss to rub the person, or to try artificial respiration, or to carefully experiment with electricity.

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* As a proper meed of respect to the great and good man whose ideas I have quoted so freely, and which have been so interesting to the reader, let me mention three recent books of merit, extraordinary even from his pen, which always writes well:

"Diseases of Modern Life." $2.00. D. Appleton & Co., Publishers, N. Y.

"Total Abstinence." 30c. Macmillan & Co., Publishers, New York.

"Canton Lectures upon Alcohol." National Temperance Society, Publishers, Reade St., New York.

Every one may rest assured that each of these works will, if generally read, save many lives, and that their reading will repay their cost.

LIGHTNING STROKE.

The testimony and the "authorities" in regard to the conditions produced by lightning upon living things are so contradictory, that there is no good grounds upon which to argue in regard to methods best for restoration. Some say, that the blood does not coagulate; others say that it does. Probably both are right. I have had no experience in such cases, except in my own, more than 40 years ago. I was unconscious instantly, not even seeing the flash. I felt nothing until after five minutes; then I came to my consciousness fully, and as suddenly as it disappeared. I could perceive all that was going on around me, but could not, for fifteen minutes, move a muscle. The lookers-on considered me dead. First one muscle, then another, came gradually under control, and I was self-restored, without any thing being done. I felt no pain nor discomfort, except the embarrassment experienced while I was conscious that I was not dead, as others supposed me to be; I could not, with the feelings and views that I had, give due respect to the opinion of the doctor.

In other cases, almost without exception, as near as I can learn, as little is done as was in my case. Sometimes a pail of water is dashed over the person, but no systematic course is taken, nor can I find that any has been authoritatively recommended.

This is not surprising. Apparent or real death by lightning is seldom seen by medical men until long after it has occurred, and then they make no effort for restoration. Therefore, in my present knowledge, or rather ignorance, I can only suggest (theoretically) that the methods applicable for restoration from suffocation be tried whenever possible. Make some effort. "Don't give up the ship" without firing a gun.

DESCRIPITON OF COLORED PLATES.

Plate 1.—Back and lower part of the brains and the whole length of the spinal cord in their skeleton box or boxes.

Nerves leading from the Centres into every part of the Body, or from all parts of it to the Centres.

Plate 2.—The "orator" exposed, with his skin removed, by which the machinery of his eloquence—the muscles—is betrayed to view. Some of those upon the left chest have been removed to show some of the deeper seated muscles.

Plate 3.—Side view of Skeleton.

Plate 4.—Fig. 1. Arteries shown by red lines, leading out from the left centre, or systemic heart, into the capillary blood-tubes existing in every part of the Body, too minute to be here represented. From them arise the Veins represented by the blue lines terminating at the right centre, or Lung heart (thus named because it throws the blood into the lungs).

Fig. 2 is a plan of the (two in one) hearts or heart, each indicated by red and blue lines.

Fig. 3 is an ideal plan showing the tubes and hearts through which the blood passes in its rounds. The hearts *PH.* (pulmonary or lung heart), *SH.* (systemic heart), are here located far apart. If *PH.* and *SH.*, the right and left sides of the heart, were pressed toward each other until they should touch, the two hearts might be inclosed in one case.

Fig. 4 is a plan in which the hearts have been brought together; the twain are now one, the colors showing the two circulations as they are named, but wrongly, as there is but one complete circulation.

The lungs are here represented as expanded by the air to the full size of the cavities in which they are formed. They always conform to the increasing and diminishing capacity of those cavities, but they would not remain expanded for an instant if the chest were open as in the Figure.

Plate 5.—Lymphatics, about which so little is clearly known that I will not betray my ignorance by telling that little.

Plate 6.—One figure is a correct, as far as it goes, representation of the arteries of the body. The other is a side view of the right brain and spinal cord, of the organs in the trunk, its walls having been removed from the right side for this purpose, and of a perpendicular division of the face in the centre.

Plate 7.—A beautiful view of the contents of the trunk walls, the front part of them being removed. Above, on each side,

notice the lungs ; between them, nearly in the centre, the heart in its tough case.

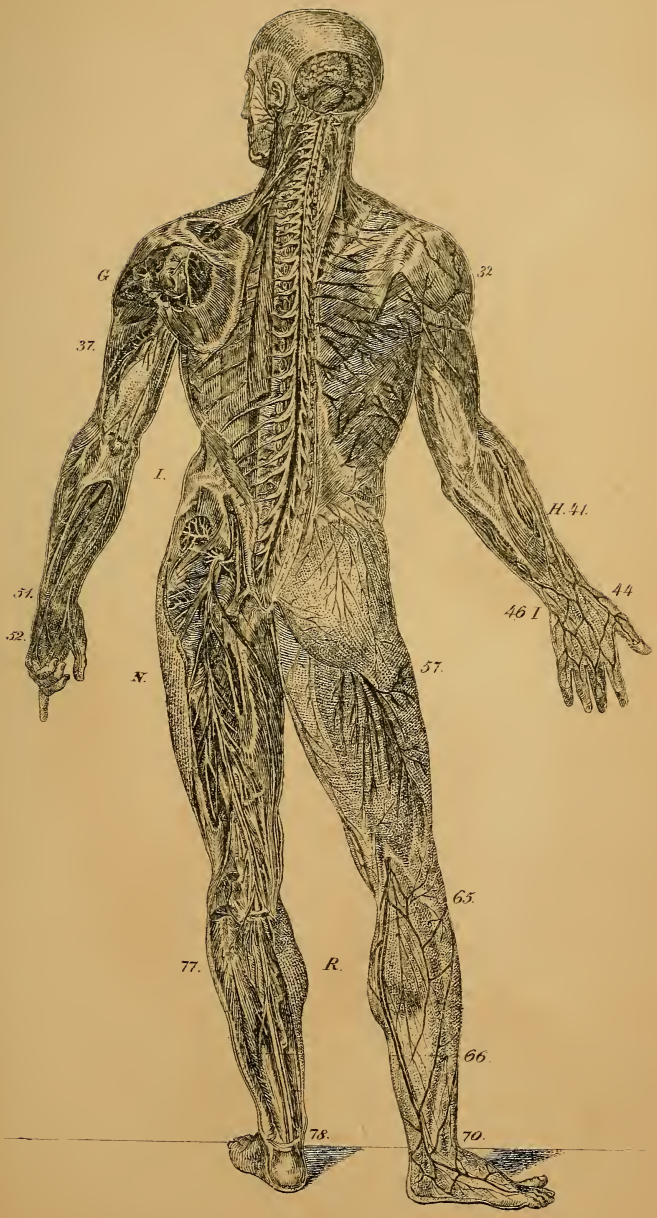
Plate 8.—A plan of the eye and its mode of aiding our sight which are striking, pleasing, and very instructive—indeed, the only means with which I am acquainted that will dispel the gross errors that have been imposed upon the minds of educated persons, by false teaching, and which induce such questions from them as are copied upon page 101.

Fig. 1 shows the white of the eyes as a thin spherical box, into which the optic nerve (2) extends, and spreads out as the retina (3), the points of the fibres of the optic nerve (2) terminating so as to form a continual surface (3). At the front a circular opening appears in the box, through which the light is represented as streaming in from one point of each of three candles, having the three natural colors, red, yellow, and blue.

The left hand candle *r* sends its light in straight spreading lines into the eye, and against the retina of its right back half. The nervous fibres commencing there, extend an influence to the nervous centres of the right brain, producing a sensation of red light, which is perceived as coming in the direction of a straight line projected from the point of the nerve acted upon in the eye. By sight we learn these two things, and no more, (*a*) the sensation caused by the light coming into the eye, and (*b*), the direction from whence it came to the eye. Upon the other hand these two effects or results can be produced only through an eye. But, as in Fig. 1, the directions of *r* from the eye would seem to be as numerous as the number of nervous fibres acted upon in the eye by the spreading rays of light coming from the point *r*, lenses are inserted in the front opening of the eye, and again just back of it, whieh bring (refract) all the light falling upon the front opening (see Fig. 2) to a single nervous fibre, making the direction appear to be single and accurate—while the sensation is intensified. To the person using the eye there are no images in it, neither direct nor inverted. Images in the eye are only for those who look into it. Fig. 9.

Figs. 3 and 4 show the so-named long- and the short-sighted eye, in which, from different causes, the same general effects, dimness of sensation and obscurity of direction, are produced, as appears in Fig. 1. The questions upon page 101 are now easily answered by any person.

Pl. I.



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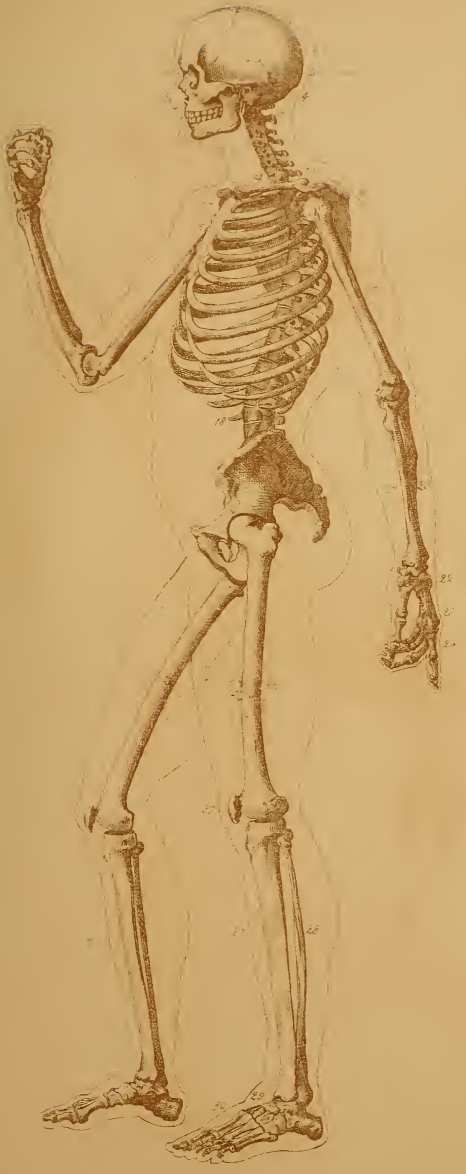

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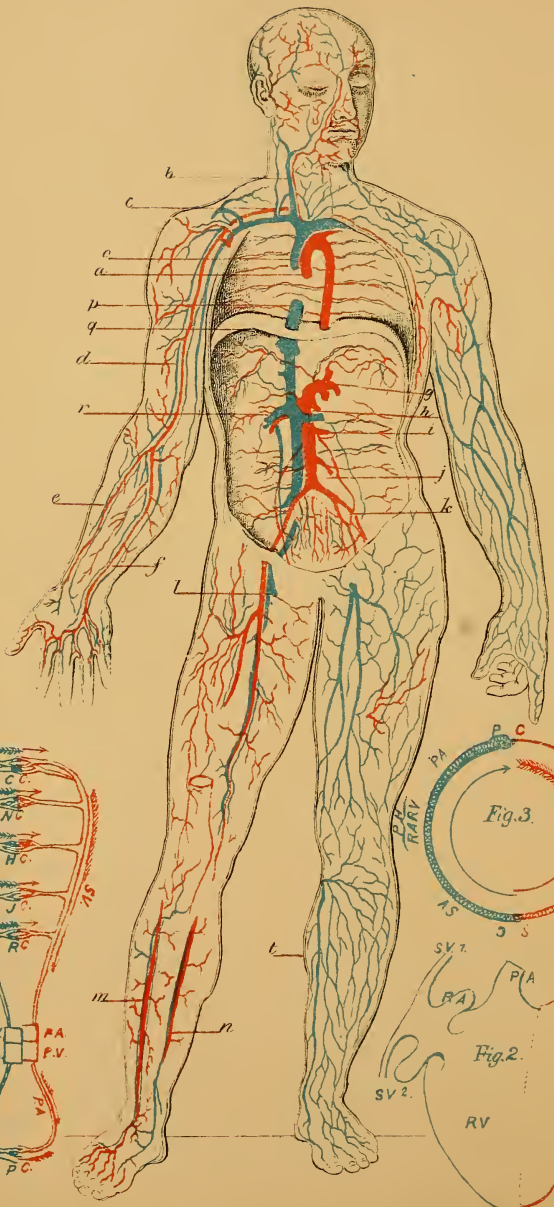
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Fig.2.
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Fig 4.
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Pl 5.

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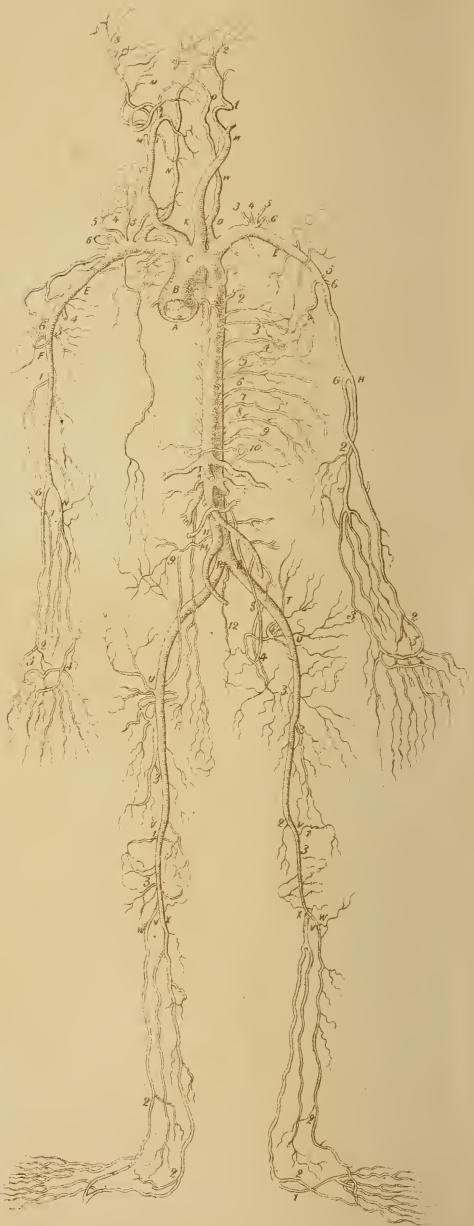

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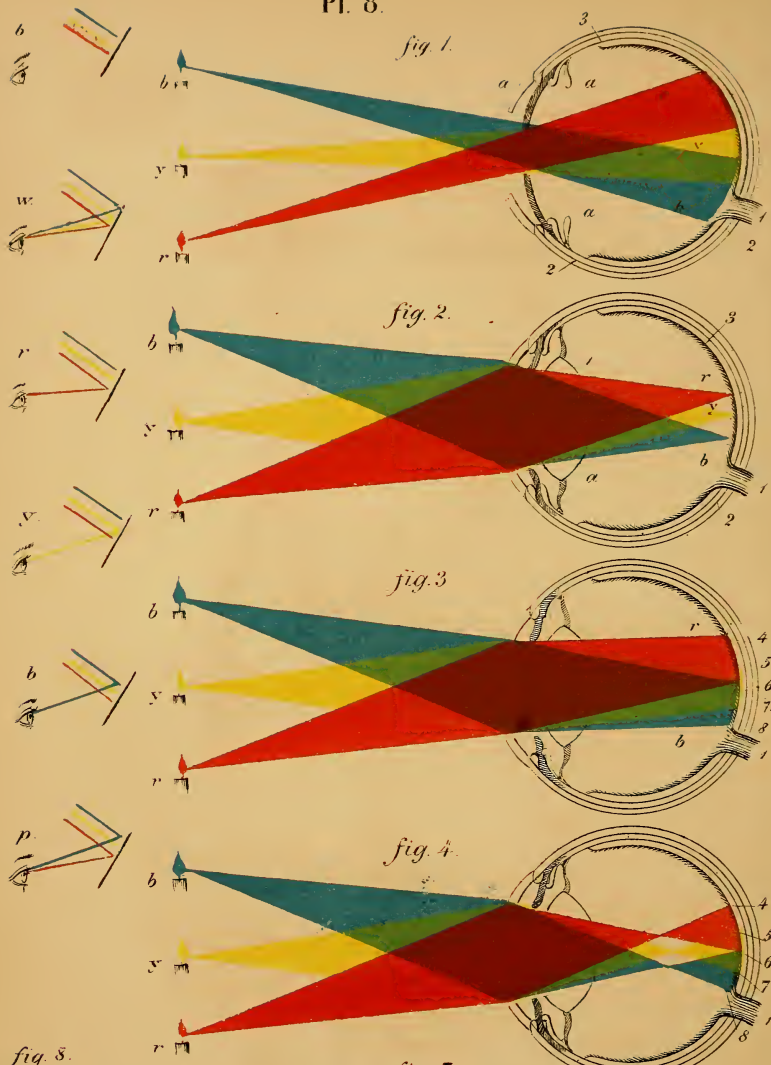
Pl. 8.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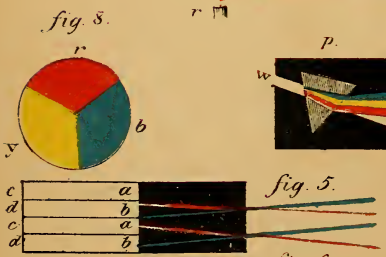
fig. 8.
fig 7.
fig. 5.
fig. 6.
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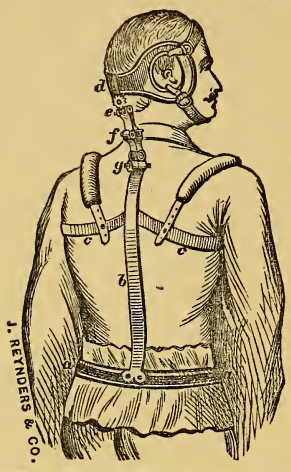

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